List of Appendices to the Consent Decree

Appendix A – Newmark ROD (copy included)

Appendix B – Muscoy ROD (copy included)

Appendix C – description and/or map of the Site – (copy included)

Appendix D – Statement of Work (copy included)

Appendix E – proposed list of planned City treatment plants and transmission systems to expand the City's potable water delivery capacity (copy included)

Appendix F – draft easement described in Section IX (Access/Institutional Controls) (copy included)

Appendix G – draft of the San Bernardino Pollution Legal Liability Clean-up Cost Cap Insurance Policy selected by the City for the investment and/or retention of the O&M Escrow, Construction Escrow and any other funds disbursed to the City for the performance of the Work or other items funded by this Consent Decree (currently being negotiated with AIG and the City; document to be provided by City)

Appendix H – draft ordinance for the Permitting Program described in Section IX (Access and Institutional Controls) (copy included)

Appendix I – Explanation of Significant Differences (not included; has not yet been signed by EPA)

Appendix J – protective orders described in Paragraph 125 (copies will be provided by City)

NEWMARK OPERABLE UNIT

RECORD OF DECISION

PART I: DECLARATION

PART II: DECISION SUMMARY

PART III: RESPONSIVENESS SUMMARY

NEWMARK GROUNDWATER CONTAMINATION SUPERFUND SITE

SAN BERNARDINO, CALIFORNIA

United States Environmental Protection Agency
Region 9 - San Francisco, California

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RECORD OF DECISION

NEWMARK OPERABLE UNIT INTERIM REMEDY

PART I. DECLARATION

SITE NAME AND LOCATION

Newmark Groundwater Contamination Superfund Site
Newmark Operable Unit
San Bernardino, California

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Newmark Operable Unit, Newmark Groundwater Contamination Superfund site, chosen in accordance with CERCLA as amended by SARA and, to the extent practicable, the National Contingency Plan. This decision is based on the administrative record for this operable unit.

In a letter to EPA dated July 29, 1993 the State of California concurred with the selected remedy for the Newmark OU.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare or the environment.

DESCRIPTION OF THE REMEDY

EPA has selected an interim remedy for the Newmark plume of groundwater contamination in the Newmark Groundwater Contamination Superfund Site. This portion of the site cleanup is referred to as the Newmark Operable Unit (OU). The Newmark OU is an interim action focusing on contamination in the underground water supply in the Bunker Hill Basin of San Bernardino, north and east of the Shandin Hills (Figures 1 and 2). The portion of the groundwater contamination west of the Shandin Hills, called the Muscoy OU, will be addressed in a separate action. An OU is a discrete action that comprises an incremental step toward comprehensively addressing Superfund site problems. The remedy and all of the alternatives presented in the feasibility study were developed to meet the following specific objectives for the Newmark OU:

- To inhibit migration of groundwater contamination into clean portions of the aquifer;
- To limit additional contamination from continuing to flow into the Newmark OU plume area;

- To begin to remove contaminants from the groundwater plume for eventual restoration of the aquifer to beneficial uses (This is a long-term project objective rather than an immediate objective of the interim action.)

The remedy involves groundwater extraction (pumping) and treatment of 8,000 gallons per minute (gpm) in the vicinity of 14th Street, between Arrowhead and Waterman Avenues, at the leading edge of the contaminant plume, and an additional 4,000 gpm at the Newmark wellfield (near 48th Street and Little Mountain Drive) where the contamination enters the eastern part of the valley (Fig. 2). The exact number, location and other design specifics of new extraction wells will be determined during the remedial design phase of the project to inhibit the migration of the contaminant plume most effectively.

All the extracted contaminated groundwater shall be treated to remove VOCs by either of two proven treatment technologies: **granular activated carbon (GAC) filtration** or **air stripping**. EPA determined during the Feasibility Study (March 1993) that these treatment technologies are equally effective at removing VOCs and are similar in cost at this OU. Both technologies have been proven to be reliable in similar applications. It is acceptable to use one technology for the northern (Newmark wellfield) facility and the other at the southern treatment facility. As a result of comments received during the public comment period, EPA may use a modification of liquid phase GAC (Advanced Oxidation pretreatment) if this modification proves to be effective and economical during design phase testing and analysis. The VOC treatment technology which best meets the objectives of the remedy for the Newmark OU will be determined during the remedial design phase, when more detailed information is available to assess effectiveness and cost.

After treatment, the water shall meet drinking water standards (maximum contaminant levels or MCLs) for VOCs. If air stripping treatment is selected, air emissions shall be treated using the best available control technology (e.g., vapor phase GAC) to ensure that all air emissions meet applicable or relevant and appropriate requirements.

The treated water will be piped to the public water supply system for distribution. Groundwater monitoring wells will be installed and sampled regularly to help evaluate the effectiveness of the remedy.

If the public water supply system does not accept any or all of the treated water (possibly due to water supply needs), any remaining portion of water will be recharged into the aquifer via reinjection wells near the edge of the plume. The number, location and design of the reinjection wells will be determined during the remedial design phase to best meet the objectives of the remedy and meet applicable or relevant and appropriate requirements.

The total duration of the Newmark OU interim remedy will be 33 years, with the first three years for design and construction. EPA

will review this action every five years throughout this interim remedy period and again at the conclusion of this period.

The remedial action for the Newmark OU represents a discrete element in the overall long-term remediation of groundwater at the Newmark Groundwater Contamination Superfund Site. The objectives of this interim action (i.e. inhibiting migration of groundwater contamination to clean portions of the aquifer, controlling additional contamination from entering this portion of the aquifer, and beginning to remove contaminant mass from the aquifer in the Newmark Plume) would not be inconsistent with nor preclude implementation of any final, overall remedial action or actions selected by EPA in the future for the Newmark Groundwater Contamination Superfund Project.

EPA is the lead agency for this project and the Department of Toxic Substances Control of the State of California Environmental Protection Agency is the support agency.

DECLARATION

This interim action is protective of human health and the environment, complies with Federal and State applicable or relevant and appropriate requirements directly associated with this action and is cost effective. This action utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable, given the limited scope of the action. Because this action does not constitute the final remedy for the site, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element will be addressed at the time of the final response action. Subsequent actions are planned to fully address the principal threats at these sites.

Because this remedy will result in hazardous substances remaining on-site above health-based levels, EPA shall conduct a review, pursuant to CERCLA Section 121, 42 U.S.C. Section 9621, at least once every five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Harry Seraii

John C. Wise
Acting Regional Administrator

8/4/93
Date

PART II. DECISION SUMMARY

This Decision Summary provides an overview of the Newmark OU interim remedy, including a description of the nature and extent of contamination to be addressed, and the remedial alternatives, the comparative analysis of the remedial alternatives, a description of the selected remedy and the rationale for remedy selection.

1.0 SITE LOCATION AND DESCRIPTION

The Newmark OU is located within the Bunker Hill Basin (also known as the Upper Santa Ana River Basin) in San Bernardino, California. The following sections present a basin description, regulatory history, and a summary of the Remedial Investigation and Feasibility Study (RI/FS) activities within the Newmark Superfund Site.

1.1 Description of the Bunker Hill Basin

The Newmark Groundwater Contamination affects a large portion of a 110 square mile aquifer in the San Bernardino Valley of southern California. (Figure 1). The aquifer, known as the Bunker Hill Basin, is bounded by the San Bernardino and San Gabriel Mountains to the north, the Crafton Hills and badlands on the southeast, and by a hydrogeologic barrier formed by the San Jacinto fault along the southwest. (Figure 2) Water flowing from all parts of the aquifer join in a confined 'artesian zone' before leaving the basin where the Santa Ana River crosses the San Jacinto faultline.

Coarse erosional material (alluvial and river channel deposits) have accumulated in the this area of the basin to depths of 400 to over 1900 feet, atop older formations that act as barriers to further vertical movement. A fold in one of these impermeable bottom formations forms the Shandin Hills (formerly called Bunker Hill in reference to military emplacements from the WWII era), which force groundwater flowing from the north and west to flow around either side rather than directly south toward the Santa Ana River.

Most of the western portion of the basin is an unconfined aquifer, with no substantial barriers to infiltration from the surface. In the lowest area of the basin (the south-central portion around the Santa Ana River), several extensive clay layers have formed an aquitard, overlying and capping the water-bearing sand and gravel aquifers. This confined portion of the aquifer produces tremendous supplies of water for nearby communities.

The aquifer receives rainfall and natural runoff from the surrounding mountains, collected floodwaters from rivers, creeks and washes, and water imported from outside the region that is spread over percolation basins. According to the San Bernardino Municipal Water District, the Bunker Hill Basin is capable of storing approximately 5 million acre-feet (1.6 trillion gallons)

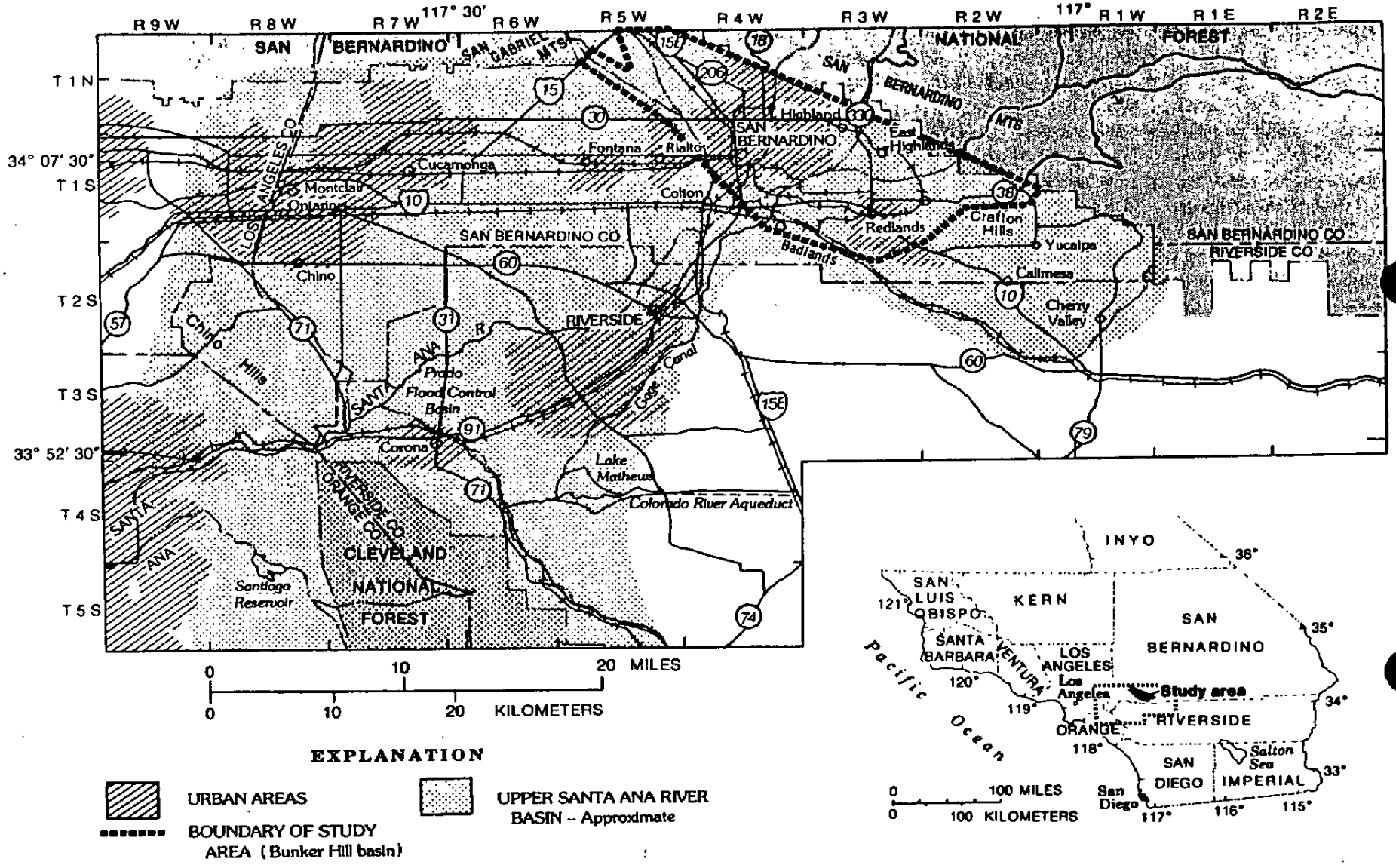
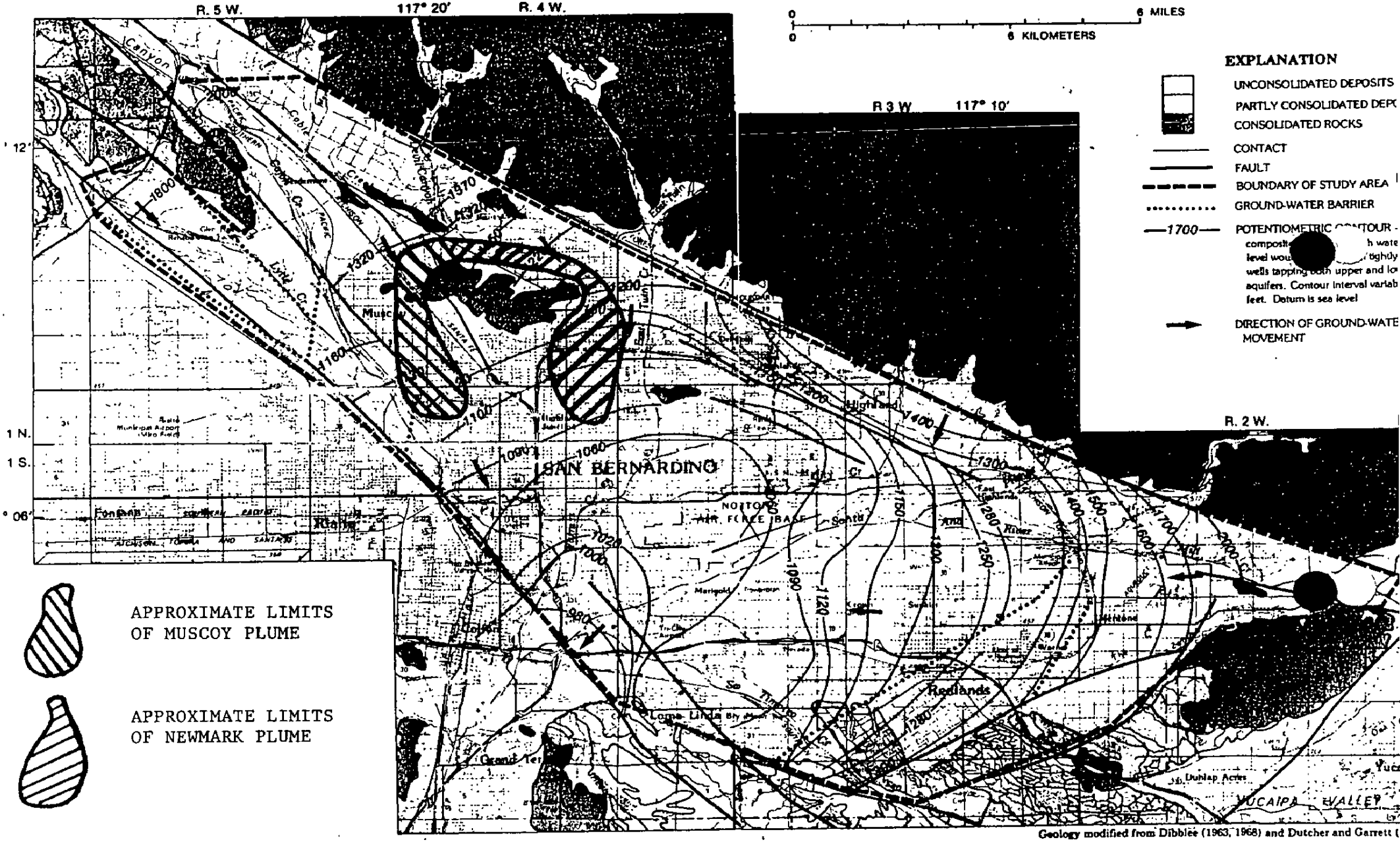


FIGURE 1.--Location of study area.



Geology modified from Dibblee (1963, 1968) and Dutcher and Garrett (

FIGURE 2. --Altitude of potentiometric surface and direction of ground-water movement, summer 1986.

and producing 250,000 acre-feet (81 billion gallons) each year. Nearly a half-million residents of San Bernardino, Riverside and surrounding communities rely on this portion of the aquifer for at least part of their water supply.

The Newmark OU lies almost entirely within the city of San Bernardino. Residential and commercial use predominates throughout the OU, although some industrial development has been identified. Very little of the area remains undeveloped.

1.2 Description and Background of the Newmark OU

The solvents (tetrachloroethene, PCE, and trichloroethene, TCE) spreading from the Newmark Superfund site threaten approximately one-half of the Bunker Hill Basin.

The EPA placed the Newmark site on the National Priorities List (NPL) in March, 1989. At that time, EPA believed the eastern (Newmark) plume of contamination to be completely separate from the western (Muscoy) groundwater contamination. Results of earlier investigations identified a possible contaminant source (a disposal pit for waste liquids at a former airport) near the Newmark wellfield.

The EPA Remedial Investigation (RI) began in late 1990. In 1992 eight sets of monitoring wells were drilled and sampled in the Newmark OU, and nearby city and state wells were also sampled by EPA. PCE and TCE were the most prevalent contaminants in all the contaminated wells. Other VOCs have also been detected in trace quantities. Results from the RI showed that the originally suspected source of the Newmark plume was not currently a source of contamination. Additional well drilling in the summer of 1992 traced groundwater contamination through a previously undiscovered underground channel flowing from the western (Muscoy) side of the valley. The Newmark site was officially expanded in September, 1992 to include the Muscoy plume. EPA began additional RI studies for the Muscoy plume and finished a feasibility study (FS) for the Newmark OU which evaluated a range of cleanup alternatives for addressing the five mile long contaminated groundwater plume. The RI/FS report for the Newmark OU was finalized in March, 1993.

2.0 SITE HISTORY

In 1980, the California Department of Health Services (DHS) initiated a monitoring program in San Bernardino to test for the presence of industrial chemicals in the water from public supply wells. The results of initial tests and of subsequent testing revealed the presence of PCE and TCE contamination in large portions of the groundwater of the Bunker Hill Basin.

Fourteen wells operated by the city of San Bernardino Water Department in the North San Bernardino / Muscoy area were found to contain concentrations of PCE and TCE above the state and federal MCLs of 5 parts per billion (ppb) for both TCE and PCE. The solvents were found in wells scattered around the north, east and

west sides of the Shandin Hills. (Figure 3) The affected wells had supplied nearly 25 percent of the water for the city of San Bernardino. As of 1993, a total of thirteen public water supply wells have been contaminated by the solvents apparently spreading from the Newmark plume, and seven water supply wells have been affected in the area of the Muscoy plume.

Following investigations by the Santa Ana Regional Water Quality Control Board and California Department of Health Services (now the California EPA Department of Toxic Substances Control), the state provided over $6 million to construct three water treatment systems, with a fourth under construction, to protect the public water supply. After years of testing it became apparent that the solvents in the groundwater were continuing to flow south, threatening many more wells operated by San Bernardino, Riverside and other communities. The state requested federal involvement to address this regional problem.

It should be noted that the cities of San Bernardino, Riverside and other water agencies in the area closely monitor the quality of drinking water delivered to residents. The water served to residents meets all Federal and state drinking water requirements.

The state investigations published in 1986 and 1989 both suggested that the widespread contamination in northern San Bernardino probably resulted from numerous small, unidentified sources. The Shandin Hills and nearby hill formations were assumed to separate the eastern (Newmark area) aquifer from the western (Muscoy area) aquifer, making it unlikely that all 14 wells could have been contaminated from a single source.

Continued monitoring of existing water supply wells and monitoring wells constructed by the state established a record of contamination relatively uniform in composition and concentration throughout the area north and east of the Shandin Hills. This pattern strongly suggested a single plume in this area.

Aerial photographic analysis was completed by EPA's Environmental Monitoring Systems Laboratory in September, 1990. This analysis, along with interviews of witnesses, suggested that the primary source of contamination was a suspected solvent disposal pit ('cat pit') on the former site of the private San Bernardino Airport. This activity occurred from the late 1950's intermittently through the early 1970's. Several minor activities in different parts of the airport site were also identified as potential waste releases. No other sources could be identified between the disposal site and the closest uncontaminated wells upgradient. The plume from this single source would extend over four miles. The waste disposal pit was also within several hundred feet of the Newmark wellfield (four City of San Bernardino Water Department wells). These wells exhibited the highest concentration of contaminants measured in any wells in the area, nearly 200 µg/l (parts per billion) of PCE.

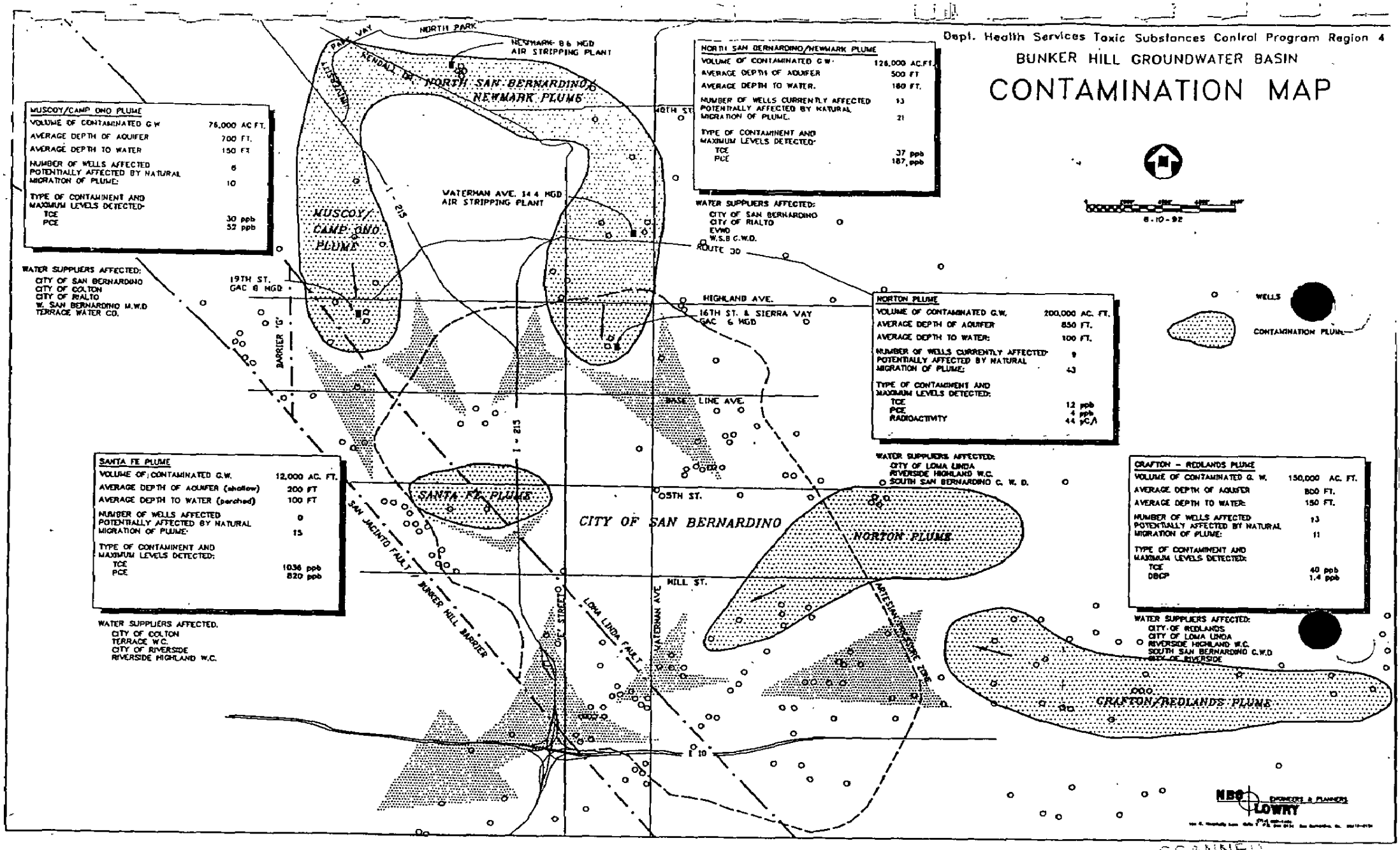


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FIGURE 3: LOCATION OF PUBLIC WATER SUPPLY WELLS AND IDENTIFIED CONTAMINANT PLUMES IN THE BUNKER HILL GROUNDWATER BASIN

In 1984-85, the area near the "cat pit", which was later identified as the probable contaminant source, was developed into a residential community.

Based on information obtained during the Remedial Investigation, the San Bernardino Airport site is no longer suspected to be the source of the Newmark Plume. It is now believed that the principle source (or sources) lies on the west side of the Shandin Hills and likely contributes to both the Newmark and Muscoy Plumes.

While ongoing investigations attempt to identify the source, EPA determined that the Newmark plume could be addressed as an interim action (the Newmark OU).

3.0 ENFORCEMENT ACTIVITIES

The results of the Remedial Investigation and other investigations undertaken by EPA and state agencies indicate that the project lead for the Newmark OU will remain with EPA until a probable source is located.

Considerable effort was expended on a PRP search while the San Bernardino Airport site was suspected to be the source of the contamination. Results of the Remedial Investigation traced the source more than one mile upgradient of the suspected source. No residual contamination was found in the unsaturated zone or the upper portion of the aquifer immediately beneath former disposal pits. The airport site is no longer considered a likely source of the contamination.

The focus of the ongoing PRP search will be potential sources located to the northwest of the Shandin Hills. These potential sources include Camp Ono (a WWII-era army base decommissioned in 1947 and subsequently developed for residential and commercial/industrial use), a closed county landfill, and an area of industrial development. The Department of Defense was sent a copy of the Newmark Proposed Plan at the start of the public comment period, along with an information request letter concerning the operations at the former Camp Ono.

4.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

EPA's preferred alternative, as well as four other alternatives were described in EPA's Proposed Plan for the Newmark OU (March 1993). The Proposed Plan was in the form of a fact sheet and was distributed to all parties on EPA's mailing list for the Newmark project. The original 30 day public comment period was extended to 6 weeks (45 days) after EPA received requests for extensions from members of the public. The public comment period closed on May 5, 1993. EPA received approximately 50 comments. These comments and EPA's responses to these comments are summarized in Part III (the Responsiveness Summary) of this ROD.

A press release to announce the release of the Proposed Plan was issued March 17, 1993. Notice of the public meeting as well as the availability of the Proposed Plan was published in the Inland Empire Sun on March 18, 1993. In addition, several newspaper articles were written about the remedial investigation, the feasibility study and the Proposed Plan for the Newmark OU including: Inland Empire Sun - March 18, 1993; Riverside Press-Enterprise - March 18, 1993. A map of the Newmark OU was provided in the Proposed Plan and the various newspaper articles published maps and described the area that would be impacted by the Newmark OU.

A public meeting was held in the City of San Bernardino Council Chambers on April 14, 1993, to discuss EPA's preferred alternative and the other alternatives. At this meeting EPA gave a brief presentation regarding the Proposed Plan, answered questions, and accepted comments from members of the public. This meeting was broadcast live on the local cable channel.

EPA expended considerable effort developing strong community relations. A Technical Advisory Committee has been successful in maintaining close communication with local and state agencies. For communication with the local community, three principle mechanisms have been employed: formal presentations (open houses, meetings with organizations and fact sheet distribution), contact with the print and electronic media and informal discussions with home-owners' associations and individuals.

The San Bernardino and Riverside papers have published a number of positive and well-researched articles about the project. Major television networks broadcast reports of the drilling operation in February, 1992. The Project Manager participated in a 90 minute call-in talk show on the public television station in August, 1992.

Invitations were accepted to speak at a city-wide Neighborhood Watch meeting and at a San Bernardino "town-hall" meeting sponsored by the California Water Education Foundation. Two open house meetings were held to introduce the field work in February, 1992, and another open house was held on-site for the community and press shortly after drilling began. Three fact sheets in addition to the Proposed Plan have been distributed.

Three different home-owners' associations accepted EPA's offer for informal discussions of the project. Drilling around these communities was greatly facilitated by open communication. Presentations were made to the staff and teachers at a local school, and the Project Manager taught the 5th grade class about groundwater and chemical pollution as it relates to the Newmark site.

5.0 SCOPE AND ROLE OF THE OPERABLE UNIT

The interim remedial action for the Newmark OU represents a discrete element in the overall long-term remediation of groundwater in the San Bernardino area. Since the source has not been identified, the final overall plan for the remediation of the entire Newmark Groundwater Contamination Site has not yet been determined. The Newmark plume constitutes a major portion of the contaminated aquifer and this remedy will be a significant step toward eventual remediation. EPA does not expect these objectives to be inconsistent with, nor preclude, any final action for the entire site.

The objectives of the Newmark OU are:

- To inhibit migration of groundwater contamination into clean portions of the aquifer;
- To limit additional contamination from continuing to flow into the Newmark OU plume area;
- To begin to remove contaminants from the groundwater plume for eventual restoration of the aquifer to beneficial uses (This is a long-term project objective rather than an immediate objective of the interim action.)

The analysis of the no-action option indicates that unless this action is implemented, the contamination will continue to spread to clean areas of the aquifer which are currently used as important sources of drinking water.

EPA is currently using the results of the Newmark OU remedial investigation in basinwide feasibility studies to address VOC contamination in the Muscoy OU and to investigate potential sources. As part of the Muscoy OU FS, EPA is revising and recalibrating the groundwater flow model for the entire site to incorporate the most recent data. When sufficient information is available on the contaminant source and transport from the source, EPA will review and evaluate various groundwater remediation options for the complete site. It is expected that the Newmark OU remedy will constitute an integral part of the complete remedy.

EPA will continue to monitor aquifer behavior and contaminant transport as part of this interim action. The information gathered will be important in the analysis of a remedy for the entire Newmark site.

6.0 SUMMARY OF NEWMARK OU SITE CHARACTERISTICS

Results of EPA's Remedial Investigation provided critical understanding in three general areas: groundwater flow characteristics, contaminant identification and concentration, and potential for exposure through the unsaturated zone.

The result that was least expected was that a significant flow of contaminated groundwater was entering the eastern (Newmark OU) side of the basin from the western portion (Muscoy OU). Most recharge to the Newmark OU part of the Bunker Hill Basin does originate along the San Bernardino Mountains to the north, and this source is not contaminated. Another important observation was that clay or silt layers that would inhibit vertical contaminant migration were not present in the monitoring well drilled near the leading edge of the plume. The contaminants cannot be expected to remain in an isolated vertical layer. A groundwater flow model was successfully developed to describe the aquifer behavior.

The contaminants identified were predominantly chlorinated solvents. Tetrachloroethene (PCE) was found in all contaminated wells at concentrations less than 40 parts per billion (ppb). Trichloroethene (TCE) was the next most common contaminant, and never exceeded 10 ppb. Other related solvents were identified at concentrations below drinking water standards. Chlorofluorocarbons (freons) were also observed. Monitoring wells were constructed to collect samples at two or more depths at each well location. Generally, the highest concentrations of contaminants were found in the deeper wells. Typically, a well near bedrock (about 500 feet deep) would have PCE levels of 10 to 20 ppb while the well in the upper part of the aquifer would have PCE less than 2 ppb. Monitoring well data compared quite closely with data from nearby water production wells.

Subsurface soil samples at the originally suspected source had no detectable levels of contaminants. Air samples from homes directly above the contaminant plume had no more volatile chemicals than samples from homes outside the plume area. Levels were not different from values observed in homes throughout the Los Angeles metropolitan area. These results confirmed that volatilization from the subsurface does not provide a measurable exposure pathway.

7.0 SUMMARY OF SITE RISKS

Baseline risk assessments are conducted at Superfund sites to fulfill one of the requirements of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The NCP (40 CFR Part 300) requires development of a baseline risk assessment at sites listed on the National Priorities List (NPL) under CERCLA. The CERCLA process for baseline risk assessments is intended to address both human health and the environment. However, due to the nature of the contamination at the site and the highly urbanized setting of the Newmark OU, the focus of the baseline risk assessment was on human health issues, rather than environmental issues.

The objective of the baseline risk assessment for the Newmark OU was to evaluate the human health and environmental risks posed by the contaminated groundwater if it were to be used as a source of drinking water without treatment. The baseline risk assessment incorporated the water quality information generated during the RI field investigation and sampling program to estimate current and future human health and environmental risks.

The risk assessment was conducted in accordance with EPA guidance including: Guidance for Conducting Remedial Investigation and Feasibility Studies under CERCLA (USEPA, 1988), Risk Assessment Guidance for Superfund, Vol. I Health Evaluation Manual (Part A) and Vol. 2 Ecological Assessment (USEPA, 1989), The Exposure Factors Handbook (USEPA, 1989), and Risk Assessment Guidance for Superfund Human Health Risk Assessment, USEPA Region IX Recommendations (USEPA, 1989).

A risk assessment involves the qualitative and quantitative characterization of potential health effects of specific chemicals on individuals or populations. The risk assessment process comprises four basic steps: 1) hazard identification, 2) dose-response assessment, 3) exposure assessment, and 4) risk characterization. The purpose of each element is as follows:

- Hazard identification characterizes the potential threat to human health and the environment posed by the detected constituents.
- Dose response assessment critically examines the toxicological data used to determine the relationship between the experimentally administered animal dose and the predicted response (e.g., cancer incidence) in a receptor.
- Exposure assessment estimates the magnitude, frequency, and duration of human exposures to chemicals.
- Risk characterization estimates the incidence of or potential for an adverse health or environmental effect under the conditions of exposure defined in the exposure assessment.

Human Health Risk Assessment

Risk assessments estimate the possibility that additional occurrences of cancer will result from exposure to contamination. The background probability of developing cancer from all causes in California is approximately one in four (or 250,000 in a million). An excess cancer risk of 1 in a million means that a person exposed to a certain level of contamination would increase the risk of developing cancer from 250,000 in a million to 250,001 in a million as a result of the exposure. EPA considers excess cancer risks greater than 100 in a million to be unacceptable.

In preparing risk assessments, EPA uses very conservative assumptions that weigh in favor of protecting public health. For

example, EPA may assume that individuals consume two liters of drinking water from wells situated within a contaminant plume every day for a 30-year period, even though typical exposure to the chemical would be far less.

EPA included two potential exposure routes (ways the contamination gets into the body) in the risk assessment:

- drinking the groundwater during residential use; and
- inhaling the chemicals in groundwater as vapors during showering.

Skin contact with contaminated water was also considered but EPA found that it didn't pose a significant risk. Results of the RI indicated that direct exposure to volatile organic compounds (VOCs) from the soil or water 100 feet below ground was insignificant at this site.

Chemicals of potential concern in the Newmark OU used in the risk assessment calculations included: PCE, TCE, cis 1,2-dichloroethene (DCE), and six other VOCs detected in at least one well. EPA will continue to monitor the groundwater in the Newmark OU for any changes that would affect the risk analysis.

The results of the risk assessment indicated that the current contaminant levels in the aquifer of the Newmark OU would not meet state or Federal drinking water standards if this water were to be delivered directly to local residents, without being treated. However, the levels are currently below the concentrations that would pose an unacceptable risk to human health, as defined by CERCLA. If the groundwater were used as a drinking water source without treatment, the chance of developing cancer during a lifetime would increase by as much as 20 in a million. EPA is taking an action at the Newmark OU in order to meet the drinking water standards (MCLs) even though the risk levels do not exceed 100 in a million.

The baseline risk assessment for the Newmark OU is presented in the Remedial Investigation and Feasibility Study Report for the Newmark OU (March 1993).

Environmental Risk Assessment

Given the present developed condition of the site and the major exposure pathway consideration of contaminated groundwater, there was no expectation for significant impact to potential environmental receptors. Urbanization has already replaced habitat potential; therefore, no significant number of receptors appeared to be present. There appeared to be no apparent mechanism for exposure to environmental receptors from contaminated groundwater. Also, there was no indication that future site plans would reinstate habitat and thereby recreate a potential for environmental receptors in the future.

8.0 DESCRIPTION OF ALTERNATIVES

Development of Alternatives to Meet Project Objectives

Before developing a range of cleanup alternatives for evaluation, EPA identified the objectives of the interim cleanup for the Newmark OU. All of the alternatives were screened for: 1) effectiveness at protecting public health and the environment, 2) technical feasibility (implementability), and 3) cost. In addition, the alternatives were developed to meet the specific cleanup objectives for the Newmark OU described previously.

Summary of Cleanup Alternatives

Based on the results of the RI, EPA identified five cleanup alternatives for addressing groundwater contamination of the Newmark OU. Detailed descriptions of these alternatives are provided in the Newmark OU RI/FS Report (March 1993). Rather than including all potential combinations of extraction locations and amounts, the initial screening process identified the most efficient extraction scenario that would meet the stated objectives. The five alternatives were evaluated based on nine specific criteria: 1) Overall Protection of Human Health and the Environment, 2) Compliance with Applicable or Relevant and Appropriate Requirements (ARARs), 3) Long-term Effectiveness and Permanence, 4) Reduction of Toxicity, Mobility or Volume through Treatment, 5) Short-term Effectiveness, 6) Implementability, 7) Cost, 8) State Acceptance, and 9) Community Acceptance.

With the exception of the **Alternative 1 - No Action**, all of the alternatives involve the extraction of 4,000 gallons per minute (gpm) of groundwater near the Newmark wellfield and 8,000 gpm of groundwater near the leading edge of the plume (approximately at 14th Street between Arrowhead and Waterman Avenues) for a period of 30 years. Individual wells would pump from 800 to 2,000 gpm, the range for a typical city drinking water well.

A computer model was used to determine that these extraction rates would result in effective inhibition of plume migration and optimal contamination removal for this interim action. With the exception of **Alternative 1 - No Action**, all of the alternatives would involve the construction and operation of a VOC treatment system, construction and sampling of additional monitoring wells, and analysis of any changes in the current operations of nearby public water supply wells.

During the first three years after the ROD is signed, the remedy would go through the remedial design and initial implementation stages. EPA must plan, build the equipment and test it to make sure it functions properly.

ALTERNATIVE 1: No Action

This alternative serves as a baseline to compare other alternatives. This alternative is evaluated to determine the risks that would be posed to public health and the environment if no action were taken to treat or contain the contamination. The **No Action Alternative** would involve only groundwater monitoring; no additional cleanup activities would be conducted. The cost of constructing the necessary monitoring wells and sampling them over 30 years would be approximately $3.5 million (present net worth).

ALTERNATIVE 2: Extract/Treat(Granular Activated Carbon)/Public Water System

Extraction

Alternative 2 involves the extraction of 8,000 gpm of contaminated groundwater placed at the leading edge of the Newmark plume and extraction of 4,000 gpm within the plume near the Newmark wellfield. The extraction wells would be located to inhibit most effectively the migration of the contaminant plume.

Treatment

The extracted groundwater would be transmitted via underground piping to Granular Activated Carbon (GAC) treatment plants (two separate treatment plants, one for each set of extraction wells). (Note that Alternative 3, involving treatment by air stripping, is considered by EPA to be equivalent to Alternative 2, and may be substituted for all or part of Alternative 2 during the design phase of the project.)

Final Use of Treated Water

The treated water would meet all legal requirements for drinking water and would be piped to the public supply system for distribution. Groundwater monitoring wells would be installed to evaluate the effectiveness of the remedial action. Following approximately 2 to 3 years for design and construction, this system would operate for 30 years. Operation of nearby public water supply wells is not expected to interfere with this remedy, although any significant changes in operations would be analyzed to determine the effect on this cleanup action. EPA will conduct a review of the project effectiveness every five years.

ALTERNATIVE 3: Extract/Treat(Air Stripping with Emission Control)/Public Water System

Alternative 3 involves the same extraction system, final distribution and monitoring design as Alternative 2. Alternative 3 differs from Alternative 2 in the treatment of the extracted groundwater to remove VOCs to meet drinking water standards. In Alternative 3, the extracted contaminated water would be treated by air stripping with emission control to meet the South Coast Air Quality Management District's requirement for best available control technology. Currently, vapor-phase granular activated carbon meets this requirement, and EPA used this technology for

cost and effectiveness analysis. New emissions control technologies developed prior to the final design could be considered if they meet the air quality requirement. Air stripping is essentially equal to GAC (Alternative 2) in effectiveness, technical feasibility and the remaining criteria.

Alternative 4: Extract/Treat (Advanced Oxidation - Peroxide/Ozone)/ Public Water System

Alternative 4 involves the same extraction, end use and monitoring design as Alternative 2. The extracted water would be treated for VOCs using an advanced oxidation process that uses peroxide and ozone to destroy (oxidize) the contaminants (rather than transferring the contaminants to a carbon filter). The advanced oxidation process was the primary treatment method for this alternative. The treated water would meet all legal requirements for a drinking water supply and would be piped to a public distribution system. Groundwater monitoring wells would be installed to evaluate the effectiveness of the action.

ALTERNATIVE 5: Extract/Treat (GAC or Air Stripping)/Return to the Aquifer via Reinjection).

Alternative 5 involves the same extraction, treatment and monitoring designs as Alternative 2 (including the option to use either GAC or air stripping to treat the extracted water for VOCs). The water would be returned to the aquifer in reinjection wells downgradient from the extraction wells. The treated water would meet drinking water standards before being returned to the aquifer.

9.0 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

A comparative analysis of the alternatives against the nine evaluation criteria is presented in this section.

No Action versus the Nine Criteria. Clearly, Alternative 1 would not be effective in the short- and long-term in protecting human health and the environment as it does not provide for removing any contaminants from the aquifer, for inhibiting further downgradient contaminant plume migration, or for reducing the toxicity, mobility and volume of contaminants through treatment. Implementing the no-action alternative would be simple and inexpensive since it involves only groundwater monitoring. As indicated by the baseline risk assessment presented in the RI Report, Alternative 1 could pose both carcinogenic and non-carcinogenic risk if a person were exposed to the groundwater from the upper zone of the aquifer, although these risks are below the 100 in a million excess risk level (10^{-4}) which EPA considers generally unacceptable. The current contaminant level would not meet state or federal drinking water standards if this water were to be delivered directly to local residents without treatment. Loss of a valuable water resource from continued degradation of the aquifer is a major

concern for the State and the public.

Overall Protection of Human Health and the Environment, Short Term Effectiveness and Long Term Effectiveness.

Alternatives 2, 3, 4 and 5 have the same effectiveness in the short and long term in reducing the risk to human health and the environment by removing contaminants from the aquifer; by inhibiting further downgradient contaminant migration; and by reducing the toxicity, mobility and volume of contaminants in the aquifer.

Reduction of Toxicity, Mobility and Volume through Treatment. The VOC treatment technologies used in Alternatives 2, 3 and 5 (either air stripping with emission control (e.g., vapor-phase GAC adsorption) or liquid phase GAC adsorption) are technically feasible and effective in meeting ARARs for VOCs in the extracted and treated groundwater. Treatment of the extracted contaminated groundwater via air stripping with vapor-phase GAC adsorption or liquid phase GAC adsorption would reduce substantially the toxicity and mobility of contaminants in the aqueous phase. The adsorption of contaminants onto the GAC would reduce the volume of contaminated media. However, a substantially larger quantity of contaminated GAC media would be generated with either air stripping with vapor-phase GAC or liquid-phase GAC systems compared to perozone oxidation (which is a destructive technology) followed by either air stripping with vapor-phase GAC adsorption or liquid-phase GAC. This contaminated GAC would require disposal or regeneration. During the design phase, an alternative emission control technology will be tested to eliminate the need for vapor-phase GAC while meeting the Best Available Control Technology requirement.

Treatment of the extracted contaminated groundwater via perozone oxidation in Alternative 4 would destroy greater than 90 percent of the VOCs, and generate a smaller quantity of contaminated GAC media compared to the conventional technologies alone. VOC treatment using perozone oxidation has only been tested and applied in pilot-scale/limited applications, and limited O&M data are available. Concern has been expressed over the reliability of this innovative technology at large-scale application for drinking water supply treatment. Incomplete oxidation can lead to the formation of by-products such as formaldehyde which would also need to addressed. Coupled with the uncertainties associated with design, capital and operational costs and day-to-day reliability at a large scale, and finally the fact that a municipality will be receiving this water, all combine to make Alternative 4 less preferable than Alternatives 2, 3 and 5 which propose using liquid phase GAC or air stripping for VOC treatment.

As a result of comments received during the public comment period, EPA further evaluated the use of an advanced oxidation system as pretreatment for liquid-phase GAC. Additional research on perozone use and revised cost estimates based on a bench scale treatability study can be found in the following technical

memorandum: Analysis of "Hybrid" Advanced Oxidation Pretreatment/ Activated Carbon Alternative for the Newmark Operable Unit (June 25, 1993) included in the Administrative Record for the Newmark OU. Pretreatment with a destructive technology has the theoretical advantage of reducing contaminant mass while enhancing the operation of a reliable conventional technology. EPA may use this modification of liquid phase GAC if this modification proves to be effective and economical during design phase testing and analysis.

Compliance with ARARs. As discussed in the ARARs section (Section 10) of this ROD, since this remedial action is an interim action, there are no chemical-specific ARARs for aquifer cleanup for any of the alternatives. For Alternatives 2 through 5, the chemical-specific ARARs for the treated water from the VOC treatment plant at this site are Federal MCLs and more stringent State MCLs for VOCs. Alternatives 2, 3, and 5 are expected to meet these ARARs for the treated water. There is some uncertainty regarding the ability of Alternative 4 to meet these ARARs because perozone has not been used to treat such high concentrations of VOCs at such high flow rates. Therefore, there is the potential for not meeting MCLs unless the air stripping or liquid-phase GAC unit following the perozone system is a redundant treatment system (which would add substantially to the cost).

For the Alternatives that involve distribution of the treated water to a public water supply system (Alternatives 2, 3 and 4), secondary drinking water standards are ARARs. For water that will be served at the tap, all legal requirements will have to be met. In Alternative 5, the treated water will meet MCLs for VOCs prior to return to the aquifer at an on-site location.

Implementability. Technically and administratively, Alternatives 2, 3, and 5 could be implemented. The technologies considered for groundwater monitoring, extraction, and conveyance are proven and have been applied extensively. For Alternative 5, the availability of an appropriate on-site location for reinjection of extracted and treated groundwater would need to be addressed.

State and Public Acceptance. Based on comments received during the public comment period, the public generally expressed support for Alternatives 2 through 5, although strong reservations were expressed about alternative 4. EPA received comments from the City of San Bernardino Water Department, two other water agencies in the area, and members of the San Bernardino community specifically in support of Alternatives 2 and 3. Comments received during the public comment period along with EPA responses are presented in Part III of this ROD, the Responsiveness Summary. In a letter dated July 29, 1993, the State (Cal-EPA) concurred with EPA's selected remedy for the Newmark OU.

Cost. The estimated total present worth of Alternatives 2, 3 and 5 ranges from $47,900,000 to $49,900,000. The total present worth cost for Alternative 4 is $61,000,000. For alternatives 2, 3 and 4, some of these costs are expected to be offset by the water supply agencies which accept the treated water. These overall project costs do not take into account the value of utilizing the

groundwater resource directly as opposed to recharging the water to the aquifer to be eventually pumped to the surface again prior to use (Alternative 5).

10.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

This section discusses Applicable or Relevant and Appropriate requirements (ARARs) for the Newmark OU. Under Section 121(d)(1) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 as amended by the Superfund Amendments and Reauthorization Act of 1986 (collectively, CERCLA), 42 U.S.C. § 9621(d) remedial actions must attain a level or standard of control of hazardous substances which complies with ARARs of Federal environmental laws and more stringent state environmental and facility siting laws. Only state requirements that are more stringent than Federal ARARs, and are legally enforceable and consistently enforced may be ARARs.

Pursuant to Section 121(d) of CERCLA, the on-site portion of a remedial action selected for a Superfund site must comply with all ARARs. Any portion of a remedial action which takes place off-site must comply with all laws legally applicable at the time of the off-site activity occurs, both administrative and substantive.

An ARAR may be either "applicable", or "relevant and appropriate", but not both. According to the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR Part 300), "applicable" and "relevant and appropriate" are defined as follows:

- Applicable requirements are those cleanup standards, standards of control, or other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than Federal requirements may be applicable. "Applicability" implies that the remedial action or the circumstances at the site satisfy all of the jurisdictional prerequisites of a requirement.

- Relevant and appropriate requirements are those cleanup standards, standard of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and that are more stringent than Federal requirements may be relevant and appropriate.

Chemical-Specific ARARs. Chemical-specific ARARs are health- or

risk-based concentration limits, numerical values, or methodologies for various environmental media (i.e., groundwater, surface water, air, and soil) that are established for a specific chemical that may be present in a specific media at the site, or that may be discharged to the site during remedial activities. These ARARs set limits on concentrations of specific hazardous substances, pollutants, and contaminants in the environment. Examples of this type of ARAR are ambient water quality criteria and drinking water standards.

Location-Specific ARARs. Location-specific requirements set restrictions on certain types of activities based on site characteristics. Federal and state location-specific ARARs are restrictions placed on the concentration of a contaminant or the activities to be conducted because they are in a specific location. Examples of special locations possibly requiring ARARs may include flood plains, wetlands, historic places, and sensitive ecosystems or habitats.

Action-Specific ARARs. Action-specific requirements are technology- or activity-based requirements which are triggered by the type of remedial activities under consideration. Examples are Resource, Conservation and Recovery Act (RCRA) regulations for waste treatment, storage or disposal.

Neither CERCLA nor the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (400 C.F.R. Part 300) provides across-the-board standards for determining whether a particular remedy will result in an adequate cleanup at a particular site. Rather, the process recognizes that each site will have unique characteristics that must be evaluated and compared to those requirements that apply under the given circumstances. Therefore, ARARs are identified on a site-specific basis from information about specific chemicals at the site, specific features of the site location, and actions that are being considered as remedies.

The following section outlines the Applicable or Relevant and Appropriate Requirements (ARARs) that apply to this site.

10.1 Chemical-Specific ARARs

10.1.1 Federal Drinking Water Standards

Section 1412 of the Safe Drinking Water Act (SDWA), 42 U.S.C. §300g-1, "National Water Regulations"; National Primary Drinking Water Regulations, 40 CFR Part 141.

EPA has established Maximum Contaminant Levels (MCLs) (40 CFR Part 141) under the Safe Drinking Water Act (SDWA) to protect public health from contaminants that may be found in drinking water sources. These requirements are applicable at the tap for water provided directly to 25 or more people or which will be supplied to 15 or more service connections. The MCLs are applicable to any water that would be served as drinking water. Under NCP Section 300.430(f)(5), remedial actions must generally attain MCLs and non-zero Maximum Contaminant Level Goals (MCLGs) for remedial actions

where the groundwater is currently or potentially a source of drinking water.

The groundwater at the Newmark OU is a potential source of drinking water. However, since the Newmark OU remedial action is an interim action, chemical-specific cleanup requirements for the aquifer such as attaining MCLs and non-zero MCLGs, which would be ARARs for a final remedy, are not ARARs for this interim action. (See NCP, 55 Fed. Reg. 8755.) Nevertheless, EPA has determined that for the treatment plant effluent from the Newmark OU, the Federal Maximum Contaminant Levels (MCLs) for VOCs and any more stringent State of California MCLs for VOCs are relevant and appropriate and must be attained regardless of the end use or discharge method for the treated water.

For the treated water which will be put into the public water supply, all legal requirements for drinking water in existence at the time that the water is served will have to be met because EPA considers serving of the water to the public (at the tap) to be off-site. Since these are not ARARs, these requirements are not "frozen" as of the date of the ROD. Rather, they can change over time as new laws and regulations applicable to drinking water change. See NCP, 55 Fed. Reg. 8758 (March 8, 1990).

10.1.2 State Drinking Water Standards

California Safe Drinking Water Act, Health and Safety Code, Division 5, Part 1, Chapter 7, §4010 et seq., California Domestic Water Quality Monitoring regulations, CCR Title 22, Division 4, Chapter 15, §64401 et seq.

California has also established drinking water standards for sources of public drinking water, under the California Safe Drinking Water Act of 1976, Health and Safety Code Sections 4010.1(b) and 4026(c). California has promulgated MCLs for primary VOCs. Several of the State MCLs are more stringent than Federal MCLs. In these cases, EPA has determined that the more stringent State MCLs for VOCs are relevant and appropriate for the treatment plant effluent from the Newmark OU interim remedy. The VOCs for which there are more stringent State standards include: benzene; carbon tetrachloride; 1,2-dichloroethane (1,2-DCA); 1,1-dichloroethene (1,1-DCE); cis-1,2-DCE; trans-1,2-DCE; and xylene. There are also some chemicals where State MCLs exist but there are no Federal MCLs. EPA has determined that these State MCLs are relevant and appropriate for the treated water prior to discharge or delivery to the water purveyor. The VOCs for which there are no Federal MCLs but for which State MCLs exist include: 1,1-DCA; 1,1,2,2-tetrachloroethane; and 1,1,2-trichloroethane.

Water served as drinking water is required to meet MCLs at the tap, not MCLGs. Therefore, EPA would generally not expect a future change in an MCLG to affect the use of treated groundwater as a drinking water source. The cumulative hazard index is also not an ARAR. However, EPA does retain the authority to require changes in the remedy if necessary to protect human health and the environment, including changes to previously selected ARARS. See

40 C.F.R. Sections 300.430(f)(1)(ii)(B)(1) and 300.430(f)(5)(iii)(C). If EPA receives new information indicating the remedy is not protective of public health and the environment, EPA would review the remedy and make any changes necessary to ensure protectiveness.

EPA has also determined that the monitoring requirements found in CCR Title 22 Sections 64421-64445.2 are relevant and appropriate for any treated water which will be delivered to a public water distribution system. However, the selection of these sections as ARARs involves only the requirements that specific monitoring be performed. It would not include any administrative requirements (such as reporting requirements) and would also not include meeting substantive standards set within these sections since no such standards have been identified by the State as being more stringent than Federal requirements. For the off-site portion of this remedy, including serving of the treated water, all applicable requirements would have to be satisfied including the monitoring requirements in CCR Title 22 Sections 64421-64445.2.

Accordingly, the chemical-specific standards for the groundwater extracted and treated under the Newmark OU interim remedy are the current Federal or State MCLs for VOCs, whichever is more stringent.

10.2 Location-Specific ARARs

No special characteristics exist in the Newmark OU to warrant location-specific requirements. Therefore, EPA has determined that there are no location-specific ARARs for the Newmark OU.

10.3 Action-Specific ARARs

10.3.1 Clean Air Act, 42 U.S.C. §7401 et seq.

Rules and Regulations of the South Coast Air Quality Management District

The Newmark OU alternative treatment of VOCs by air stripping, whereby the volatiles are emitted to the atmosphere, triggers action- specific ARARs with respect to air quality.

The Clean Air Act regulates air emissions to protect human health and the environment, and is the enabling statute for air quality programs and standards. The substantive requirements of programs provided under the Clean Air Act are implemented primarily through Air Pollution Control Districts. The South Coast Air Quality Management District (SCAQMD) is the district regulating air quality in the San Bernardino area.

The SCAQMD has adopted rules that limit air emissions of identified toxics and contaminants. The SCAQMD Regulation XIV, comprising Rules 1401, on new source review of carcinogenic air contaminants is applicable for the Newmark OU. SCAQMD Rule 1401 also requires that best available control technology (T-BACT) be employed for new stationary operating equipment, so the cumulative

carcinogenic impact from air toxics does not exceed the maximum individual cancer risk limit of ten in one million (1×10^{-5}). EPA has determined that this T-BACT rule is applicable for the Newmark OU because compounds such as PCE and TCE are present in groundwater, and release of these compounds to the atmosphere may pose health risks exceeding SCAQMD requirements.

The substantive portions of SCAQMD Regulation XIII, comprising Rules 1301 through 1313, on new source review are also ARARs for the Newmark OU.

The SCAQMD also has rules to limit the visible emissions from a point source (Rule 401), which prohibits discharge of material that is odorous or causes injury, nuisance or annoyance to the public (Rule 402), and limits down-wind particulate concentrations (Rule 403). EPA has determined that these rules are also ARARs for the Newmark OU interim remedy.

10.3.2 Water Quality Standards for Reinjection and Discharges of Treated Water to Surface Waters or Land

Federal Standards

The Safe Drinking Water Act provides Federal authority over injection wells. The Federal Underground Injection Control Plan is codified in Part 144 of 40 C.F.R and prohibits injection wells such as those that would be located at the Site from (1) causing a violation of primary MCLs in the receiving waters and (2) adversely affecting the health of persons. 40 C.F.R. §144.12. Section 144.13 of the Federal Underground Injection Control Plan provides that contaminated ground water that has been treated may be reinjected into the formation from which it is withdrawn if such injection is conducted pursuant to a CERCLA cleanup and is approved by EPA. 40 C.F.R. §144.13. These regulations are applicable to any Newmark OU treated water that is reinjected into the aquifer.

The Resource Conservation and Recovery Act (RCRA) Section 3020 is also an action-specific ARAR. This section of RCRA provides that the ban on the disposal of hazardous waste into a formation which contains an underground source of drinking water (set forth in Section 3020(a)) shall not apply to the injection of contaminated groundwater into the aquifer if: (i) such injection is part of a response action under CERCLA; (ii) such contaminated groundwater is treated to substantially reduce hazardous constituents prior to such injection; and (iii) such response action will, upon completion, be sufficient to protect human health and the environment. RCRA Section 3020(b).

State Standards

Reinjection to Groundwater

For any reinjection to the basin, including spreading, or discharges to surface water or land that occur on-site, the reinjected or discharged water must meet all action-specific ARARs for such reinjection or discharge. The ARAR applicable to the reinjected water (Alternative 5) is:

- The Santa Ana Regional Water Quality Control Board's Water Quality Control Plan for the Santa Ana River (and specific Bunker Hill Sub-basins), which incorporates State Water Resources Control Board Resolution No. 68-16, "Statement of Policy with Respect to Maintaining High Quality of Waters in California." Resolution No. 68-16 requires maintenance of existing State water quality unless it is demonstrated that a change will benefit the people of California, will not unreasonably affect present or potential uses, and will not result in water quality less than that prescribed by other State policies.

Temporary Discharges to Surface Water

EPA anticipates that there may be short-term discharges of treated water to the flood control channel or storm drains during the initial operation of the VOC treatment plant and on certain other limited occasions. The ARAR for any treated water that is discharged, on a short term basis, to surface waters is the National Pollutant Discharge Elimination System (NPDES) Program which is implemented by the SARWQCB. In establishing effluent limitations for such discharges, the SARWQCB considers the Water Quality Control Plan for the Santa Ana River Basin, Bunker Hill Sub-basins (the "Basin Plan"), which incorporates Resolution 68-16, the Inland Surface Water Plan and Temperature Plan for Surface Waters, and the best available technology economically achievable (BAT). See, Cal. Water Code § 13263.

Since the RWQCB did not identify specific substantive discharge requirements or technology standards for such temporary discharges, EPA has reviewed the Basin Plan (with related documents) and considered BAT and has made certain determinations for the short-term discharges to surface waters. In order to comply with this ARAR, any groundwater that will be discharged, on a short-term basis, to surface waters on-site must be treated to meet Federal MCLs or State MCLs for VOCs, whichever is more stringent.

10.3.3 Secondary Drinking Water Quality Standards

The State of California's Secondary Drinking Water Standards (SDWS) which are more stringent than the Federal Secondary Drinking Water Standards shall be ARARs for the Newmark OU if the final use option involves serving treated groundwater as drinking water. 22 CCR §64471. The California SDWS are selected as ARARs because they

are promulgated State standards and are relevant and appropriate to the action of supplying the treated water to a public water supplier. Although California SDWS are not applicable to non-public water system suppliers, the California SDWS are relevant and appropriate since the treated water under this action would be put into the public drinking water system. Since the Federal SWDS are not enforceable limits and are intended as guidelines only, they are not ARARs for this action. Furthermore, since the State SDWS are more stringent than the Federal SDWS, EPA has not selected the Federal SDWS as requirements for this action. In summary, if the treated water is to be served as drinking water, the treated water at the point of delivery must meet the California SDWS. If the treated water is recharged or (temporarily) discharged to the flood control channel, the water will not be required to meet State SDWS.

The Safe Drinking Water Act provides Federal authority over injection wells. The Federal Underground Injection Control Plan is codified in Part 144 of 40 C.F.R and prohibits injection wells such as those that would be located at the Site from (1) causing a violation of primary MCLs in the receiving waters and (2) adversely affecting the health of persons. 40 C.F.R. §144.12. Section 144.13 of the Federal Underground Injection Control Plan provides that contaminated ground water that has been treated may be reinjected into the formation from which it is withdrawn if such injection is conducted pursuant to a CERCLA cleanup and is approved by EPA. 40 C.F.R. §144.13. These regulations are applicable to any Newmark OU treated water that is reinjected into the groundwater on the Newmark site.

10.3.4 Resource Conservation and Recovery Act (RCRA) and Hazardous Solid Waste Amendment (HSWA) Standards, 42 U.S.C. §§6901-6987.

RCRA, passed by Congress in 1976 and amended by the Hazardous and Solid Waste Amendments of 1984, contains several provisions that are ARARs for the Newmark OU. The State of California has been authorized to enforce its own hazardous waste regulations (California Hazardous Waste Control Act) in lieu of the Federal RCRA Program administered by the EPA. Therefore, State regulations in the California Code of Regulations (CCR), Title 22, Division 4.5, Environmental Health Standards for the management of Hazardous Wastes (hereinafter the State HWCA Regulations), are now cited as ARARs instead of the Federal RCRA Regulations.

Since the source of the contaminants in the groundwater is unclear, the contaminated groundwater is not a listed RCRA waste. However, the contaminants are sufficiently similar to RCRA wastes that EPA has determined that portions of the State's HWCA Regulations are relevant and appropriate. Specifically, the substantive requirements of the following general hazardous waste facility standards are relevant and appropriate to the VOC treatment plant for Alternatives 2 through 5: Section 66264.14 (security requirements), Section 66264.15 (location standards) and Section 66264.25 (precipitation standards).

In addition, an air stripper or GAC contactor would qualify as a RCRA miscellaneous unit if the contaminated water constitutes

RCRA hazardous waste. EPA has determined that the substantive requirements for miscellaneous units set forth in Sections 66264.601 -.603 and related substantive closure requirements set forth in 66264.111-.115 are relevant and appropriate for the air stripper or GAC contactor. The miscellaneous unit and related closure requirements are relevant and appropriate because the water is similar to RCRA hazardous waste, the air stripper or GAC contactor appear to qualify as a miscellaneous unit, and the air stripper or GAC contactor should be designed, operated, maintained and closed in a manner that will ensure the protection of human health or the environment.

The land disposal restrictions (LDR), 22 CCR Section 66268 are relevant and appropriate to discharges of contaminated or treated groundwater to land. The remedial alternatives presented do not include land disposal of untreated groundwater. Because of the uncertainty in the levels of contamination and volumes of water to be derived from monitoring and extraction wells at this site, these waters must be treated to meet Federal and State MCLs for VOCs, whichever is more stringent, prior to discharge to land. By meeting the Federal and State MCLs for VOCs before reinjection, Alternative 5 will satisfy the RCRA LDRs.

The container storage requirements in 22 CCR Sections 66264.170 -.178 are relevant and appropriate for the storage of contaminated groundwater over 90 days.

On-site storage or disposal of the spent carbon from the treatment system could trigger the State HWCA requirements for storage and disposal if the spent carbon contains sufficient quantities of hazardous constituents that cause the spent carbon to be classified as a characteristic hazardous waste. If the spent carbon is determined to be a hazardous waste under HWCA (Sections 66261 and 66262), the requirements for handling such waste set forth in Sections 66262 and 66268 are applicable.

Certain other portions of the State's HWCA's regulations are considered to be relevant but not appropriate to the VOC treatment plant. EPA has determined that the substantive requirements of Section 66264.15 (general inspection requirements), Section 66264.15 (personnel training) and Sections 66264.30-66264.56 (Preparedness and Prevention and Contingency Plan and Emergency Procedures) are relevant but not appropriate requirements for this treatment system. EPA has made this determination because the treatment plant will be required to have health and safety plans and operation and maintenance plans under CERCLA that are substantively equivalent to the requirements of Sections 66264.15, 66264.30-66264.56.

10.3.5 California Water Well Standards.

Substantive standards for construction of public water supply wells have been published by the State as the California Water Well Standards. While these standards have not been specifically promulgated as an enforceable regulation and are therefore not ARARs, all groundwater facilities designed, located and constructed

to produce drinking water must be constructed in accordance with these standards. Since the remedy involves delivery of the treated water to the public supply system, EPA has determined that the action will comply with substantive Water Well Standards for construction of water supply wells, such as sealing the upper annular space to prevent surface contaminants from entering the water supply. Standards for location of the extraction wells are not appropriate, since the effectiveness of the remedy is dependent upon the well locations. Additionally, wells constructed solely for treatment and reinjection with no delivery to the public supply system would not be subject to these water well construction standards.

10.4 Summary of ARARs for the Newmark OU Interim Remedy

EPA has determined a number of chemical-, and action-specific ARARs for the Newmark OU interim remedy. All of the alternatives that involve groundwater extraction and treatment could achieve the chemical-specific treatment standards for the groundwater at the point of delivery. However, Alternative 4 which uses an advanced oxidation process is a less certain technology than liquid-phase GAC adsorption or air stripping for such a large volume of water and therefore is somewhat less likely to achieve the chemical-specific ARARs.

Requirements of nonenvironmental laws, such as California OSHA regulations (8 CCR 5192) are not considered as ARARs and all such requirements applicable at the time of the activity would have to be satisfied.

11.0 THE SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the detailed analysis of the alternatives, and public comments, EPA has determined that Alternative 2: Extraction, Treatment of VOCs by liquid phase GAC (or air stripping with Best Available Control Technology for emissions), and Conveyance to a public water distribution system, in combination with Alternative 5 (as a contingency): Extraction, Treatment of VOCs, and Recharge to the aquifer, is the most appropriate interim remedy for the Newmark OU.

Alternative 2 involves groundwater extraction (pumping) of 8,000 gallons per minute (gpm) in the vicinity of 14th Street, between Arrowhead and Waterman Avenues, at the leading edge of the contaminant plume, and an additional 4,000 gpm at the Newmark wellfield (near 48th Street and Little Mountain Drive) where the contamination enters the eastern part of the valley. Various locations and scenarios for extraction wells and rates of extraction are proposed in the FS report for the Newmark OU; however, all design decisions for this interim remedy will be made during the remedial design phase. During the remedial design phase the locations proposed for extraction wells and scenarios for rates of extraction per individual well may be selected or new ones may be selected. The exact number, location and other design specifics of new extraction wells will be determined during the remedial design phase of the project to inhibit the migration of the contaminant plume most effectively. Wherever appropriate, existing water production wells will be utilized for the remedy, and new wells will be constructed as necessary, as discussed in the Newmark OU FS Report.

All the extracted contaminated groundwater shall be treated to remove VOCs by either of two proven treatment technologies: **granular activated carbon (GAC) filtration** or **air stripping**. EPA determined during the Feasibility Study (March 1993) that these treatment technologies are equally effective at removing VOCs and are similar in cost at this OU. Both technologies have been proven to be reliable in similar applications. It is acceptable to use one technology for the northern (Newmark wellfield) facility and the other at the southern treatment facility. Existing treatment facilities (e.g., the air stripping towers at the Newmark wellfield) may be modified and incorporated into the remedy as appropriate. As a result of comments received during the public comment period, EPA may use a modification of liquid phase GAC (Advanced Oxidation pretreatment) if this modification proves to be effective and economical during design phase testing and analysis. The VOC treatment technology which best meets the objectives of the remedy for the Newmark OU will be determined during the remedial design phase, when more detailed information is available to assess effectiveness and cost.

The treated water exiting the treatment plant shall meet all MCLs and secondary drinking water standards. If air stripping treatment is selected, air emissions shall be treated using the best available control technology (e.g., vapor phase GAC or an acceptable innovative technology) to ensure that all air emissions

meet ARARs.

The treated water will be piped to the public water supply system for distribution. Groundwater monitoring wells will be installed and sampled regularly to help evaluate the effectiveness of the remedy. More specifically, groundwater monitoring will be conducted no less frequently than quarterly to obtain information needed to: 1) evaluate influent and effluent water quality, 2) determine and evaluate the capture zone of the extraction wells, 3) evaluate the vertical and lateral (including downgradient) migration of contaminants, 4) (if the contingency alternative is implemented) to evaluate the effectiveness of the recharge well system and its impact on the remedy and 5) to monitor any other factors associated with the effectiveness of the interim remedy determined to be necessary during remedial design. Monitoring frequency may be decreased to less than quarterly if EPA determines that conditions warrant such a decrease.

EPA has selected Alternative 5 as a contingency if the public water supply system does not accept any or all of the treated water (possibly due to water supply needs). Any remaining portion of water will be recharged into the aquifer via reinjection wells near the edge of the plume. The number, location and design of the reinjection wells will be determined during the remedial design phase to best meet the objectives of the remedy and meet applicable or relevant and appropriate requirements. With the exception of the need to meet secondary MCLs and final use of the treated water, Alternative 5 is identical to Alternative 2 above.

The total duration of the Newmark OU interim remedy will be 33 years, with the first three years for design and construction. EPA will review this action every five years throughout this interim remedy period and again at the conclusion of this period.

The VOC treatment plant of the Newmark OU interim remedy (whether it be Alternative 2, Alternative 5 or a combination thereof) shall be designed and operated so as to prevent the unknowing entry, and minimize the possible effect of unauthorized entry, of persons or livestock into the active portion of the facility. A perimeter fence shall be erected around the VOC treatment plant if an adequate fence or other existing security system is not already in place at the plant site. This fence should be in place prior to initiation of the remedial action and should remain in place throughout the duration of the remedy. The VOC treatment plant shall also be designed and operated so as to prevent releases of contaminated groundwater from the plant.

The selected remedy for the Newmark OU meets all of EPA's nine evaluation criteria. The selected remedy is equally effective as the other alternatives in the short-term and long term reduction of risk to human health and the environment by removing contaminants from the aquifer, by inhibiting further downgradient migration of the contaminant plume, and by reducing the toxicity, mobility and volume of contaminants in the aquifer.

The VOC treatment technologies selected (liquid phase GAC or

air stripping with best available control technology for emissions) are technically feasible and proven effective at meeting ARARs for VOCs in the treated groundwater.

Alternative 2, in combination with Alternative 5, could be implemented, both technically and administratively.

In a letter dated July 29, 1993, the State concurred with EPA's selected remedy. EPA received several public comments during the public comment period, the majority of which expressed support for EPA's preferred alternative. These comments, along with EPA's responses are presented in Part III of this ROD, the Responsiveness Summary.

The selected remedy is protective of human health and the environment, meets ARARs, and provides beneficial uses (distribution to a public water supply and/or recharge) for the treated water. The selected remedy is cost-effective. The estimated cost of Alternative 2 has a total present worth of $49,900,000, which is in the middle of the range for all five alternatives. The estimated total cost of Alternative 5 is $48,100,000.

12.0 STATUTORY DETERMINATIONS

As required under Section 121 of CERCLA, the selected interim remedial action is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the interim remedial action, and is cost effective. The selected remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment to reduce toxicity, mobility, and volume as a principal element.

The selected interim remedial action is protective of human health and the environment in that it removes significant VOC contaminant mass from the upper zones of the aquifer and inhibiting further downgradient and vertical migration of contaminated groundwater.

The VOC treatment technologies selected (liquid phase GAC or air stripping with best available control technology for emissions) are technically feasible and proven effective at meeting ARARs for VOCs in the treated groundwater and the air.

The selected remedy permanently and significantly reduces the toxicity, mobility and volume of hazardous substances in the aquifer as well as the extracted groundwater.

Because this remedy will result in hazardous substances remaining on-site above health-based levels, EPA shall conduct a review, pursuant to CERCLA Section 121, 42 U.S.C. Section 9621, at least once every five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

13.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The only significant change to the Newmark OU interim remedy proposed in the Proposed Plan fact sheet dated March, 1993, involves the possible use of a modification to the liquid phase GAC treatment technology.

As a result of comments received during the public comment period, EPA further evaluated the use of an advanced oxidation system as pretreatment for liquid-phase GAC. Additional research on system effectiveness and revised cost estimates based vendor reports can be found in the following technical memorandum: Analysis of "Hybrid" Advanced Oxidation Pretreatment / Activated Carbon Alternative for the Newmark Operable Unit (June 25, 1993) included in the Administrative Record for the Newmark OU. Pretreatment with a destructive technology has the theoretical advantage of reducing contaminant mass while enhancing the operation of a reliable conventional technology. EPA may use this modification of liquid phase GAC if this modification proves to be effective and economical during design phase testing and analysis.

The impact of this potential change is that the reliability of the conventional liquid phase GAC technology is retained and some desirable destruction of contaminants is realized. Since this option would only be a modification of the conventional technology, the advanced oxidation system would not need to be designed to achieve full treatment of the VOCs, reducing the cost of the innovative component of the treatment. The cost of operation of the liquid phase GAC would also be reduced, offsetting a portion of the increased capital costs.

PART III. RESPONSIVENESS SUMMARY

For Public Comments received during the Public Comment Period for the Newmark Operable Unit Interim Remedy at the Newmark Groundwater Contamination Superfund Site San Bernardino, California

EXECUTIVE SUMMARY

This Responsiveness Summary addresses comments received from the public, State agencies, and local agencies on EPA's proposed interim cleanup plan for the Newmark OU. Comments from the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) on the RI/FS report and the draft Proposed Plan for the Newmark OU were received by EPA prior to issuing the Proposed Plan and initiating the public comment period. DTSC's comments and EPA's responses are available for review in the Administrative Record for the Newmark OU and are not included in this responsiveness summary.

EPA held a 45-day public comment period on the RI and FS reports, Proposed Plan and other Newmark OU administrative record documents between March 22, 1993, and May 5, 1993. A public meeting was held in San Bernardino on April 14, 1993. Approximately 25 representatives of the community, local agencies, and EPA attended the meeting and the meeting was broadcast live on a local cable channel. EPA staff made a presentation on the Newmark OU alternatives, including EPA's preferred alternative, and answered questions. A transcript of the meeting is included in the Administrative Record for the Newmark OU.

EPA received questions and comments orally from six members of the public during the April 14, 1993, public meeting.

EPA also received seven letters containing comments from interested community members, the San Bernardino Water Department, the City of Rialto Utilities Department, the East Valley Water District, and the California Department of Health Services, Environmental Health. These letters are included in the Newmark OU Administrative Record.

All but one of the commenters were generally supportive of most aspects of Preferred Alternative presented in the proposed plan. A number of comments expressed strong approval of the preferred alternative. A committee of water supply agencies expressed a willingness to cooperate in the remedy (specifically the acceptance of treated water by the public supply system), with issues to be resolved during subsequent design phase.

Although there was general agreement that the reliability of conventional treatment technologies was desirable, many commenters were concerned about disposal of spent carbon. As a result of comments received during the public comment period, EPA has undertaken a study of a modification of GAC treatment which would

oxidize a large proportion of the contaminants before the water enters the carbon system. EPA may use this enhanced liquid phase GAC (with Advanced Oxidation pretreatment) if this modification proves to be effective and economical during design phase testing and analysis.

One commenter recommended that the proposed action at the Newmark OU be postponed until further investigation could support justification of the project.

RESPONSIVENESS SUMMARY

for PUBLIC COMMENTS RECEIVED from

March 22 through May 5, 1993

ON THE PROPOSED PLAN FOR THE

NEWMARK OPERABLE UNIT INTERIM REMEDIAL ACTION

AT THE NEWMARK GROUNDWATER CONTAMINATION SUPERFUND SITE,

SAN BERNARDINO, CALIFORNIA

This document summarizes and responds to all significant comments received during the public comment period (45 days) on EPA's Proposed Plan for the Newmark Operable Unit (OU) of the Newmark Groundwater Contamination Superfund Site in San Bernardino, California. This summary is divided into two parts. Part I provides a summary of the major issues raised in written comments contained in seven letters received by EPA during the comment period. Part II summarizes the questions and comments made during the public meeting on the Proposed Plan held in San Bernardino on April 14, 1993. Since the distinction between questions and formal comments was not made completely clear at the public meeting, all questions and comments will be included in this responsiveness summary. Most of the questions received at the public meeting were addressed during the meeting, and a brief synopsis of EPA's response with any needed clarification is presented in this Responsiveness Summary.

Copies of all the written comments received by EPA are included in the Newmark OU Administrative Record, available for review at the information repositories for the Newmark Superfund Site. The transcript of the public meeting, including all the questions, comments and responses made during the meeting, is also available at the information repositories.

The comments from each source are grouped together and the commenter is identified at the start of the series of comments or questions.

RESPONSIVENESS SUMMARY - PART I

WRITTEN COMMENTS

1) Commenters (San Bernardino Water Department and committee of nine interested water supply agencies) recommend further study of administrative and technical (facility) details for conveyance of treated water to public water supply agencies.

EPA response: EPA agrees that these issues should be addressed in the design phase of this project. Cooperation from the water

agencies in identification of critical technical and administrative areas is greatly appreciated. It should be noted that the EPA recognizes that this stage of the project is still preliminary and conceptual. EPA's analysis presented in the Feasibility Study and supported by a report prepared for the City of San Bernardino Water Department, concluded that conveyance of treated water from this project to public water supply agencies is a feasible alternative. However, since many important details remain, such as those expressed in this comment, a contingency for final use of the treated water is included in this decision.

2) Commenters recommend further study of costs associated with acceptance of water by public agencies.

EPA response: This issue has not been formally addressed in the RI/FS. Negotiations during the remedial design phase with the agencies accepting the water will require more detailed information. The cost analyses in the FS have not assumed that the agencies accepting the water would bear any of the pumping or treatment costs, to allow a consistent basis for comparison of the costs of the various alternatives. EPA intends that a Feasibility Study should be sufficiently detailed to allow for informed decision making and selection of a proposed plan. More detailed analyses of the selected remedy occur after the public comment period and during the Remedial Design phase.

3) Commenters recommend further study of water rights issues.

EPA response: This issue will be addressed in the design phase. (Also see discussion in the ARARs section, Section 10, of this document.) Formal and informal discussions with water agencies have led EPA to conclude that the agencies which might accept the water are likely to have sufficient rights to the water. The final analysis of this issue depends on the results of negotiations to be held during the design phase.

4) Commenters recommend further study of water quality issues, particularly Total Dissolved Solids (TDS).

EPA response: EPA has been collecting and will continue to collect data on the dissolved solids content of the groundwater near the proposed extraction locations. This information will be considered in negotiations with the agencies which might accept the treated water. We understand that excessive TDS may limit the ability of a number of these agencies to accept water from this project.

5) Commenters express willingness of San Bernardino Water Department to cooperate, pending study of impacts on the Department's distribution system.

EPA response: EPA is grateful for the continued support and cooperation of the San Bernardino Water Department in this project.

6) Commenters express support of project from nine local water supply agencies.

EPA response: The active participation of local water supply agencies in the Newmark RI/FS is gratefully acknowledged. Support of the proposed alternative by the community is an important criterion in selection of the remedy for this Operable Unit.

7) Commenter (East Valley Water District) supports project and intends to negotiate with EPA to accept water.

EPA response: (See response to previous comment, # 6, above)

8) Commenter (City of Rialto Water Utilities) supports the project, preferring delivery to public supply agencies to recharge.

EPA response: EPA is grateful for this expression of support. Recharge to the aquifer will only be considered as a contingency in the event that acceptance by water supply agencies cannot be negotiated. EPA expects that these negotiations will be successful.

9) Commenter (Eric Piehl, College Park Place Homeowners Assn.) expresses appreciation for EPA community involvement and useful information.

EPA response: EPA gratefully acknowledges the patience and active involvement of the community during the RI/FS. The information provided during the project is intended to encourage this involvement, and this information is itself a response to the community's interests.

10) Commenter recommends more rapid action.

EPA response: Reaction to a hazardous chemical release must balance a need for rapid response with careful data gathering and analyses. During this project, EPA has attempted to move the process along as quickly as possible and will continue to seek opportunities to streamline the process.

11) Commenter supports emission control at the Newmark facility.

EPA response: If air stripping is the most efficient and economical treatment method at the Newmark facility, all emissions control regulations will be met. EPA has determined that regulations of the South Coast Air Quality Management District (see Section 10 of this document) will be complied with at this project.

12) Commenter recommends continuing efforts to identify the source of contamination.

EPA response: In September of 1992, EPA initiated an RI/FS to address the source identification. Sample collection and analysis from the few existing wells in the area (called the Muscoy Operable Unit) has been completed recently. Additional observation wells will be necessary, and EPA expects to construct these in the next few months. Preliminary results of this investigation will be made public as soon as possible.

13) Commenter recommends EPA action on Muscoy Plume and other plumes in the area.

EPA response: As discussed for Comment 12, EPA has already started to address the Muscoy Plume (the Muscoy OU of the Newmark Superfund project). Preliminary groundwater flow modelling is nearing completion for the Muscoy plume, and EPA will use much of the information gathered during the Newmark OU to accelerate the process for Muscoy.

EPA does not have direct authority to respond to other releases of contaminants (outside the Superfund site) until that specific site is determined to be a National Priority (currently about 1200 sites nationwide), unless there is an imminent threat to human health or the environment. EPA can attempt to influence the action of state and local authorities by sharing technical information and by open discussion with officials and the community. Additionally, if the contamination from any source threatens the effectiveness of the remedy selected for a Superfund site, EPA has the authority to require an appropriate response.

It appears that EPA's activities at the Newmark site has increased public awareness of other plumes in the basin.

14) Commenter supports alternative 2 (liquid phase GAC) for new treatment facilities and alternative 3 (air stripping) for the existing system at the Newmark wellfield.

EPA response: Comments of support from the community are greatly appreciated. Both alternatives 2 and 3 have been selected as remedies for the Newmark OU. While it appears that a modification of the existing air stripping towers would be the most rapid and economical alternative at the Newmark wellfield, results of a treatability study for emissions control could make liquid phase GAC more attractive over the lifetime of the project. Conversely, extremely positive results of emission control technology tests could actually make air stripping preferable to GAC for the new facility. However, the current information would support the preferences of this commenter.

15) Commenter requests additional information on the health effects of PCE and TCE.

EPA response: A summary of current knowledge of health effects has been received from ATSDR and is included in the record for this project. We apologize that this information was not readily available at the public meeting for the proposed plan. The information about the human health risks that was presented at the meeting is consistent with the summary from ATSDR. EPA does not expect that this additional information would alter community acceptance of the project. This information will be made available at the information repositories in San Bernardino (the County library at 104 West Fourth Street and the Municipal Water District office at 1350 South 'E' Street).

16) Commenter recommends study of current emissions at air stripping towers.

EPA response: EPA will meet the standards for emission control established by the South Coast Air Quality Management District if air stripping is incorporated into the EPA action. The current air stripping units in the Newmark area are part of an action undertaken by the State of California in cooperation with local agencies. It is clear to EPA that emission controls will be installed at these units, although there have been delays due to design difficulties. EPA has been informed that the state is overseeing monitoring of emission levels in the area around the units. Consequently, EPA does not intend to conduct its own study of stripping tower emissions. The effectiveness of emission controls on any EPA stripping towers will be carefully monitored.

17) Commenter supports continued coordination with state and local agencies.

EPA response: Advice and information from various state and local agencies have been quite valuable to this project. EPA intends to maintain this close coordination, including the continuation of the Technical Advisory Committee.

18) Commenter requests extension of comment period (for comments gathered at April 25th Environmental Fair).

EPA response: The comment period was extended to May 5 as a result of requests from the community.

19) Commenter expresses concern over limited distribution of treated water due to water agency facilities and policies.

EPA response: Protection of human health is EPA's overriding concern in this project. It has been determined that water which meets the established drinking water standards will be protective of human health. If local water supply agencies accept the treated water from this project, the point at which the water is conveyed to the water supply agencies (essentially at the end of the treatment system) will be considered "off-site". Off-site actions must meet all applicable regulations at the time of the activity. Your comment will be brought to the attention of the water supply agencies which negotiate to accept the water.

20) Commenter recommends consideration of direct use of imported water rather than recharge to a contaminated aquifer.

EPA response: Unless water import and recharge actions threaten the effectiveness of the Superfund remedy, EPA has no direct authority over such activities. Recharge of imported water provides important storage capacity and reduces the need for expensive transmission pipelines. These critical advantages of a groundwater aquifer increases the importance of protection and cleanup of this contaminated aquifer.

21) Commenter (Gillem Lucas, Air and Water Technologies Corp.) notes that changing air quality regulations will impact emission control analysis of alternative 3.

EPA response: Regulations that are determined to be Applicable or Relevant and Appropriate "freeze" at the time the ROD is signed. If EPA receives new information that the standards met by the remedy are not protective of public health and the environment, EPA would review the remedy and make any changes necessary to ensure protectiveness.

22) Commenter recommends re-analysis of treatment design by another consultant (some innovative combinations have been overlooked).

EPA response: As a result of comments from the public, EPA has analyzed a modification of the liquid phase GAC treatment alternative which would incorporate an innovative advanced oxidation pretreatment. This modification will receive additional study during the design phase. EPA actively seeks technical as well as non-technical input from the community during the public comment period and throughout the RI/FS process.

EPA's ability to enter into contracts is restricted by Federal procurement regulations. The performance of the consultants used on all Superfund projects is regularly scrutinized.

23) Commenter (Diana Lee, California DHS, Environmental Health) recommends evaluation of hazards from current emissions at stripping towers.

EPA response: (See response to Comment #16 above.)

24) Commenter recommends formal survey for private wells in plume area.

EPA response: No formal documentation of EPA's extensive search for existing private wells has been published. Neither EPA, the various state agencies involved, nor local agencies have succeeded in locating any wells other than those noted in the RI/FS. Efforts taken by EPA include: 1) Identification of all wells registered with the state (and San Bernardino County which has been delegated authority for well registration), 2) Review of searches by Cal EPA-DTSC and the Regional Water Quality Control Board during the 1980's, 3) Close communication with local water supply agencies, 4) Repeated requests for information from the public made during numerous public meetings and in interviews with print and electronic media, 5) Review of historical aerial photos for land use and land development patterns, 6) Analysis of a 1945 report/map locating all wells known at the time (this is entered in the administrative record and available at the repositories). Aside from an infeasible door-to-door search, the effort to locate private wells has been exhaustive. EPA will continue to take every effort to locate private wells in the area of the plume, and will conduct a similar search for wells in the Muscoy area.

25) Commenter (Bret Raines) asserts that water supply wells do not provide adequate data for risk assessment.

EPA response: EPA has acknowledged in the RI that the use of water quality data from water production wells (in addition to data from

wells designed solely for water quality monitoring) increases the uncertainty of the calculated risk values. Use of these data (sampled, analyzed and validated by EPA) was justified by a number of considerations, including: 1) Careful analysis of the lithology (geologic structure) at nearby monitoring wells showed no barrier to vertical flow in the contaminated area; 2) The values from production wells corresponded with the highest values from nearby monitoring wells both at the Newmark wellfield and the Electric Avenue(monitoring)/Leroy(production) well area; 3) The history of contaminant levels in production wells at the leading edge of the plume indicates recent arrival of contaminants, and relatively low concentrations would be expected; 4) Values from production wells would tend to be underestimates. The decision to take this action would not be affected even if the VOC concentration were greater and the calculated risk levels were higher.

26) Commenter states that radionuclide buildup in GAC and radon emissions from stripping tower was inadequately addressed in proposed plan.

EPA response: A recent EPA analysis of this issue form the geologically similar San Fernando Valley Superfund sites has been included in the Administrative record for the Newmark OU. There is potential for buildup of short half-life radionuclides in GAC units which will be readily addressed with relatively minor design considerations.

27) Commenter notes that numerical cleanup standards are not explicitly established.

EPA response: Cleanup standards for the aquifer are not established in an interim action ROD. Treatment standards for VOCs in the extracted water are explicitly established at the MCL or more stringent state drinking water standards.

28) Commenter suggests that if injection wells are outside the plume, state anti-degradation regulations would not be met.

EPA response: Alternative 5, the contingency for reinjection if negotiations with water supply agencies fail, would seek to reinject treated water near the edge of the plume, although not necessarily at the most downgradient edge. EPA has not identified the location of reinjection wells which would meet these desired criteria with certainty, although the eastern edge of the plume was used in the FS for the sake of analysis. The state anti-degradation regulations (State Water Board Resolution 68-16) is an ARAR for this remedy and as such will be complied with if the reinjection contingency is necessary. If the injection wells must be located in an area that is clearly off-site, the action must comply with all legal regulations at the time of the activity.

29) Commenter believes that "Approved RI" format was not followed. (Presumably referring to EPA RI guidance documents.)

EPA response: The Newmark RI/FS has been consistent with EPA policies and guidance. Use of guidance is subject to site specific

considerations and are not absolutely prescriptive. The Newmark RI/FS process was streamlined whenever possible without compromising the decision selection, in agreement with current EPA policy.

30) Commenter feels that inadequate data was collected to support model assumptions.

EPA response: The flow model used for the limited purposes of the Newmark RI/FS met accepted standards of calibration and verification. This project was quite fortunate to be able to subject the analysis to scrutiny by local and national experts in hydrogeology. The general behavior of the EPA model was consistent with the conceptual understanding of these experts and with independent efforts to model the basin. Additional data will be considered as it becomes available, and the model will be revised as necessary. However, EPA is satisfied with the model as an analytical tool for this phase of the project.

31) Commenter feels that the ARARs review is inadequate.

EPA response: The ARARs review for federal regulations compares favorably with the thoroughness of ARARs reviews for other recent California groundwater Superfund sites. It is the responsibility of the state to identify and justify potential state ARARs. The state's analysis for Newmark OU ARARs was quite thorough.

32) Commenter expresses opinion that Newmark project is inconsistent with other Superfund sites in the state, particularly sites at which USEPA is not the lead.

EPA response: The decision-making process and the remedy selected for the Newmark OU is quite similar to other recent groundwater contamination Superfund sites in southern California and alluvial basin sites in Arizona. EPA staff for the San Fernando Valley, San Gabriel Valley and Indian Bend Wash (Arizona) sites have provided invaluable advice and consultation to the Newmark project.

33) Commenter recommends further investigation prior to any action.

EPA response: Aside from this commenter, state and public comments are supportive of rapid implementation of the selected remedy for the Newmark OU. EPA has conducted a thorough technical and administrative analysis of the Newmark project and has determined that sufficient information is available to support the selected remedy.

RESPONSIVENESS SUMMARY - PART II

Questions and comments from Public meeting held April 14, 1993

Jeff Wright

1) Requests two week extension to public comment period.

EPA response: This request was granted. (See response to Comment #18 in Part I above.)

2) Expresses concern over air stripping without emission control.

EPA response: EPA agrees with the concern expressed and will comply with South Coast Air Quality Management District emission regulations if air stripping is implemented. (See response to Comment #11 in Part I above.)

3) Questions effectiveness of Carbon Filtration (liquid GAC).

EPA response: This technology has been used for treating water supplies contaminated with PCE and TCE throughout the country for many years, and is considered quite reliable. Currently, several GAC treatment systems are operating satisfactorily in the San Bernardino area to treat contaminated public water supply.

4) How often is carbon changed?

EPA response: The carbon is changed when its adsorption capability declines and it cannot provide the desired treatment of the water. The major factors affecting the time for changing the carbon are the concentration of the incoming water and the flow rate of the water through the carbon. The system is carefully monitored, and the carbon is changed before there can be any compromise in the effectiveness of the treatment.

EPA estimates that the carbon would need to be changed approximately every nine months at the rates and concentrations assumed in the Feasibility Study. Current operations in San Bernardino (treating lower concentrations) have required a single change of carbon after nearly two years.

5) Concern over disposal of spent carbon, transfer of contamination to another medium (carbon), and eventual incineration.

EPA response: EPA has decided to pursue a modification of the conventional treatment technologies (which do not destroy or recycle the contaminants) which would chemically destroy a large percentage of the contaminants. This innovative modification will need to be tested during the design phase. Additionally, the state and local agencies have had recent success in testing a method to recapture contaminants from the emissions of air strippers. EPA will comply with the Best Available Control Technology (BACT) requirement for air stripper emissions, and expects that this new technology will become the BACT for this project.

6) Supports remedy that destroys or recycles contaminants.

EPA response: See response to previous comment, #6 in Part II, above.

John Stevens

7) Would like more information on health effects of PCE and TCE, and particularly long term exposure effects.

EPA response: See response to Comment #15, in Part I above.

8) Questions protectiveness of 5 parts per billion (ppb) of PCE and TCE in the treated drinking water.

EPA response: Using assumptions that would tend to overestimate the risk, EPA has calculated that meeting the federal and state drinking water standards for PCE and TCE (both established at 5 ppb) would bring the carcinogenic risk from drinking water into the range of one in a million. This is within the level defined as "acceptable". The actual treatment levels achieved will be closely monitored and the information will be available to the public.

9) Questions whether effects in San Bernardino have been studied.

EPA response: The incidence of cancer in San Bernardino and other communities is monitored in a Cancer Registry, which are reviewed by state and local public health agencies and by national health agencies where Superfund sites are involved. Results of this monitoring effort have not shed any light on effects of this contamination. It is difficult to detect a definite trend of increased cancer incidence in a community without much more data than has been collected to date, and it is even more difficult to relate cancer incidence with a possible cause (such as contaminated water).

10) Comments that information on toxicological effects should be made widely available to San Bernardino residents.

EPA response: See response to Comment #15 in Part I above, and response to Comment #8 in Part II.

Tim Ayr

11) Would like more information about the source of contamination (particularly Camp Ono).

EPA response: See response to Comment #12 in Part I above.

12) Is there any information about unregistered wells?

EPA response: See response to Comment #24 in Part I above.

13) Is there a short-term health threshold for PCE and TCE?

EPA response: Most short-term health thresholds for these potential

carcinogens have been established for concentrations in the air rather than in drinking water.

The U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health, published concentrations that are "Immediately dangerous to Life or Health" at 500 parts per million for PCE and 1000 ppm for TCE. Permissible Exposure Limits, which are not to be exceeded during any 8-hour work shift, have been established by OSHA at 25 ppm for PCE and 50 ppm for TCE. EPA has calculated Removal Action Levels (levels for which a 7 year exposure in drinking water would not present an unacceptable risk) for PCE at 70 parts per billion and for TCE at 300 parts per billion.

14) Would PCE and TCE be vertically distributed in the aquifer?

EPA response: When these compounds are not dissolved in water, both would tend to sink since they are more dense than water. When either PCE or TCE are released into the soil above the groundwater, the upper portion of the groundwater would be contaminated first, and then deeper parts of the aquifer will be affected as the contaminants sink deeper. Eventually (after many years) the PCE and TCE might be expected to form a pool at the bottom of the aquifer. Once the contaminants are dissolved in the water (a fairly slow process) the contaminated water would tend to spread laterally, rather than vertically, unless pumping or recharge caused a vertical gradient.

15) How fast is the contamination moving?

EPA response: The leading edge of the contaminant plume may be moving as fast as the water is moving in the aquifer. EPA has estimated that the groundwater velocity ranges from about 180 feet per year (0.51 ft/day) near the Newmark Wells, to 573 ft/year just east of Little Mountain, and about 310 ft/year in the lower two-thirds of the plume. (See Section 6 of the Remedial Investigation Report)

16) Are there other contaminants besides PCE and TCE? Would chemical mixtures form new contaminants?

EPA response: EPA has detected a number of other compounds related to PCE and TCE, which may be expected in these solvent mixtures from the original manufacturing process or the pattern of solvent use and disposal. None of the compounds were detected in exceptionally high concentrations. (See the RI Report.) There does not appear to be evidence of reactions occurring from the mixing of these compounds or other potential waste chemicals.

17) Is the water served in San Bernardino safe to drink?

EPA response: See response to Comment #8 in Part II above.
Eric Piehl

18) Is there a threat to residents living above the plume?

EPA response: EPA's investigations have not shown a measurable

exposure of the groundwater contaminants to the population living directly above the groundwater contaminant plume at the Newmark site.

19) Is disclosure of the project required when selling a house above the plume?

EPA response: There are certain State of California disclosure requirements for conditions which would affect property values. A real estate agent or attorney should be able to advise how these regulations apply in San Bernardino. The size of the Newmark plume would mean that a large portion of San Bernardino (and perhaps neighboring communities outside the city limits) are within or near the Superfund site, even though the exposure threat is minimal (see previous response).

20) Recommends emission control of Newmark air stripping towers.

EPA response: See response to Comment #11 in Part I above.

21) How often is carbon (liquid GAC) changed?

EPA response: See response to Comment #4 in Part II above.

22) How is spent carbon disposed?

EPA response: There are a number of ways that carbon is dealt with after it has exhausted its ability to treat contaminated water. The "spent carbon" is often treated at very high temperatures to burn off the contaminants while regenerating the carbon. Another method is to burn the carbon and the contaminants together (often as a fuel source for power generation). The City of San Bernardino has used this method recently, shipping the used carbon to Kansas City. Another common and currently legal option is to dispose of the carbon in a licensed landfill.

23) Are other chemicals formed during incineration of spent carbon?

EPA response: If the incineration is conducted properly, formation of chemical by-products should be negligible.

24) Will water treatment systems clean up water to better than MCLs?

EPA response: See response to Comment #8 in Part II above.

25) Expresses concern over limited distribution of treated water due to water agency facilities and policies.

EPA response: See response to Comment #19 in Part I above.

26) Recommends consideration of direct use of imported water rather than recharge to a contaminated aquifer.

EPA response: See response to Comment #20 in Part I above.

Helen Kopczynski

27) What storage facilities will be required for treated water while deciding whether to reinject or convey to public supply?

EPA response: The decision to reinject or not will be made before the system is constructed, and no storage facility will be required.

28) Which water supply system will receive the treated water?

EPA response: There have been no commitments made by EPA or any water supply agency. EPA's current expectations are that a large portion of the treated water would be accepted by the San Bernardino Water Department, with the remainder by several other local agencies in the San Bernardino area. See the letters from these agencies referred to in Comments #1 through 8 in Part I above.

29) Have these treatment systems been used before in public water supply situations?

EPA response: See response to Comment #3 in Part II above.

30) Operation and location of injection wells is unclear.

EPA response: The general potential location of injection wells was suggested in the Feasibility Study Report. It must be noted that the exact location of any of the facilities that may be constructed will depend on additional information to be gathered during the design phase of the project. Some important considerations for location of injection wells are discussed in the response to Comment #28 in Part I above.

31) Locations for all the proposed actions are not clearly explained.

EPA response: As discussed in the previous response, EPA suggested some potential locations for facilities. More precise locations will be dependent on additional information to be gathered during the design phase. Since gathering such information is time-consuming and costly, EPA seeks public comment on the range of alternatives considered before selecting which remedy (or set of remedies) to continue into the design phase.

32) Operating costs for the remedies seems high.

EPA response: The Newmark Superfund site is an enormously large site with vast quantities of water involved. Additionally, the project is likely to be in operation for 30 years or more. The cost to society of the loss of this resource (the aquifer in the San Bernardino Valley) is much greater than the cost of this project, without consideration of the possible health risks of the spreading contaminant plume.

EPA's cost estimates are not precise since the final design contains a number of uncertainties. The analyses to develop the

costs have been quite thorough given these limitations. (See the Feasibility Study report for the detailed analyses.)

Among the factors which may change the operating costs are efficiencies which may be realized by allowing the local water departments to operate the system. EPA is also expecting that the value of the treated water can be agreed upon in negotiations with the water departments, and a portion of this value reimbursed to the cleanup project (either directly or indirectly).

33) Cost for this OU should be spent on source identification and control.

EPA response: EPA agrees that source identification and control is an essential goal and has committed a substantial budget to these tasks. Initiating the Newmark OU interim action is not expected to interfere with progress on the source investigation.

Sharon Coffelt

34) Is the contamination that is entering the Newmark OU area from the west flowing around the hills, between the hills or through the hills?

EPA response: The flow of contaminated groundwater has been traced to the gap between Wiggins Hill to the north (Wiggins is the name of the hill north of the intersection of Kendall and University Parkway) and Shandin Hills (Little Mountain) to the south. The hills themselves are formed from material that is not expected to permit significant water flow.

35) Will the natural hot water from parts of this aquifer impact the project?

EPA response: The contaminants are not expected to reach the parts of the aquifer where natural thermal water exists. Both PCE and TCE are relatively stable, with boiling points around 200° F.

36) EPA has provided helpful information.

EPA response: EPA is grateful for comments from the community. See response to Comment #9 in Part I above.

B

MUSCOY PLUME OPERABLE UNIT

RECORD OF DECISION

PART I: DECLARATION

PART II: DECISION SUMMARY

PART III: RESPONSIVENESS SUMMARY

NEWMARK GROUNDWATER CONTAMINATION SUPERFUND SITE

SAN BERNARDINO, CALIFORNIA

United States Environmental Protection Agency
Region 9 - San Francisco, California

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MUSCOY PLUME OPERABLE UNIT INTERIM REMEDY

PART I. DECLARATION

SITE NAME AND LOCATION

Newmark Groundwater Contamination Superfund Site
Muscoy Plume Operable Unit
San Bernardino, California

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Muscoy Plume Operable Unit, Newmark Groundwater Contamination Superfund site, chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. §§9601 et seq., and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (National Contingency Plan or NCP), 40 CFR Part 300. This decision is based on the administrative record for this operable unit.

In a letter to EPA dated March 21, 1995 the State of California, through the California Environmental Protection Agency's (Cal-EPA) Department of Toxic Substances Control (DTSC) concurred with the selected remedy for the Muscoy Plume Operable Unit.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare or the environment.

DESCRIPTION OF THE REMEDY

EPA has selected an interim remedy for the Muscoy plume of groundwater contamination in the Newmark Groundwater Contamination Superfund Site. This portion of the site cleanup is referred to as the Muscoy Plume Operable Unit (OU). An OU is a discrete action that comprises an incremental step toward comprehensively addressing Superfund site problems. The Muscoy Plume OU is an interim action focusing on contamination in the underground water supply in the Bunker Hill Basin of San Bernardino, west of the Shandin Hills (Figures 1 and 2). The portion of the groundwater contamination north and east of the Shandin Hills, called the Newmark OU, was addressed in a separate action (Newmark OU Record of Decision, August 4, 1993). The selected remedy and all of the alternatives presented in the feasibility study were developed to meet the following specific objectives for the Muscoy Plume OU:

- To inhibit migration of groundwater contamination into clean portions of the aquifer;
- To protect downgradient municipal supply wells south and southwest of the Shandin Hills;
- To begin to remove contaminants from the groundwater plume for eventual restoration of the aquifer to beneficial uses. (This is a long-term project objective rather than an immediate objective of the interim action.)

The remedy involves groundwater extraction (pumping) and treatment of 6,200 gallons per minute (gpm) in San Bernardino at the leading edge of the contaminant plume (Fig. 2), which is approximately between Highland Avenue and Base Line Street, west of Interstate 215 and east of Medical Center Drive. The exact number, location and other design specifics of the extraction wells will be determined during the remedial design phase of the project to inhibit the migration of the contaminant plume most effectively.

All the extracted contaminated groundwater shall be treated to remove Volatile Organic Compounds (VOCs) by either of two proven treatment technologies: **granular activated carbon (GAC) filtration** or **air stripping**. EPA determined during the Feasibility Study (December 1994) that these treatment technologies are equally effective at removing VOCs and are similar in cost at this OU. Both technologies have been proven to be reliable in similar applications. The VOC treatment technology which best meets the objectives of the remedy for the Muscoy Plume OU will be determined during the remedial design phase, when more detailed information is available to assess effectiveness and cost.

After treatment, the water shall meet all applicable or relevant and appropriate drinking water standards for VOCs (See Table 2). If air stripping treatment is selected, air emissions shall be treated using the best available control technology (e.g., vapor phase GAC) to ensure that all air emissions meet applicable or relevant and appropriate requirements.

The treated water will be transferred to a public water supply agency for distribution. Groundwater monitoring wells will be installed and sampled regularly to help evaluate the effectiveness of the remedy.

If the public water supply agency does not accept any or all of the treated water (possibly due to water supply needs), any remaining portion of water will be recharged into the aquifer via reinjection wells near the edge of the plume. The number, location and design of the reinjection wells will be determined during the remedial design phase to best meet the objectives of the remedy and meet applicable or relevant and appropriate requirements.

The total duration of the Muscoy Plume OU interim remedy will be approximately 33 years, with the first three years for design and construction. EPA will review this action every five years throughout this interim remedy period and again at the conclusion of this period to ensure that the remedy continues to be protective of human health and the environment.

The remedial action for the Muscoy Plume OU represents a discrete element in the overall long-term remediation of groundwater at the Newmark Groundwater Contamination Superfund Site. The objectives of this interim action (i.e., inhibiting migration of groundwater contamination to clean portions of the aquifer, protecting downgradient municipal supply wells south and

southwest of the Shandin Hills and beginning to remove contaminant mass from the aquifer in the Muscoy plume) are not inconsistent with and will not preclude implementation of any final, overall remedial action or actions selected by EPA in the future for the Newmark Groundwater Contamination Superfund Site.

EPA is the lead agency for this project and the Department of Toxic Substances Control of the State of California Environmental Protection Agency is the support agency.

DECLARATION

This interim action is protective of human health and the environment, complies with federal and state applicable or relevant and appropriate requirements directly associated with this action and is cost effective. This action utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable, given the limited scope of the action. Because this action does not constitute the final remedy for the site, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element will be addressed at the time of the final response action. Subsequent actions are planned to fully address the principal threats at this site.

Because this interim remedy will result in hazardous substances remaining on-site above health-based levels, EPA shall conduct a review, pursuant to CERCLA Section 121, 42 U.S.C. Section 9621, at least once every five years after commencement of remedial action to ensure that the interim remedy continues to provide adequate protection of human health and the environment.

Keith A. Takata — 3-24-95

Keith A. Takata
Deputy Director for Superfund
Hazardous Waste Management Division

Date

PART II. DECISION SUMMARY

This Decision Summary provides an overview of the Muscoy Plume OU interim remedy, including a description of the nature and extent of contamination to be addressed, the remedial alternatives, the comparative analysis of the remedial alternatives, a description of the selected remedy and the rationale for remedy selection.

1. SITE LOCATION AND DESCRIPTION

The Muscoy Plume OU is located within the Bunker Hill Basin (also known as the Upper Santa Ana River Basin) in San Bernardino, California. The following sections present a basin description, regulatory history, and a summary of the Remedial Investigation and Feasibility Study (RI/FS) activities within the Newmark Groundwater Contamination Superfund Site (hereinafter referred to as the Newmark Superfund Site).

1.1 Description of the Bunker Hill Basin

The groundwater contamination at the Newmark Superfund Site affects a large portion of a 110 square mile aquifer in the San Bernardino Valley of southern California. (Figure 1). The aquifer, known as the Bunker Hill Basin, is bounded by the San Bernardino and San Gabriel Mountains to the north, the Crafton Hills and badlands on the southeast, and by a hydrogeologic barrier formed by the San Jacinto fault along the southwest. (Figure 2) Waters flowing from all parts of the aquifer join in a confined "artesian zone" before leaving the basin where the Santa Ana River crosses the San Jacinto faultline.

The groundwater in this aquifer is a valuable resource, currently serving nearly a half-million residents of San Bernardino, Riverside and surrounding communities. According to the San Bernardino Valley Municipal Water District, the Bunker Hill Basin aquifer is capable of storing approximately 1.6 trillion gallons and producing 81 billion gallons each year.

Coarse erosional material (alluvial and river channel deposits) have accumulated in the this area of the basin to depths of 400 to over 1900 feet, atop bedrock formations that act as barriers to further vertical movement. The Shandin Hills, created by an upward fold in these impermeable bedrock formations, forces groundwater flowing from the north and west to flow around either side of the hills rather than directly south toward the Santa Ana River.

Most of the western portion of the basin is an unconfined aquifer, with no substantial barriers to infiltration from the surface. In the lowest area of the basin (the south-central portion around the Santa Ana River), several extensive clay layers have formed an aquitard, overlying and capping the water-bearing sand and gravel aquifers. This confined portion of the aquifer produces a large supply of water for nearby communities. The aquifer receives rainfall and natural runoff from the surrounding mountains, collected floodwater from rivers, creeks and washes, and water imported from outside the region that is spread over percolation basins.

The Muscoy plume encompasses a portion of the Bunker Hill aquifer located beneath the western portion of the city of San Bernardino and an unincorporated part of San Bernardino County known as the Muscoy community. Residential and commercial use predominates throughout the Newmark Superfund Site. Very little of the area remains undeveloped.

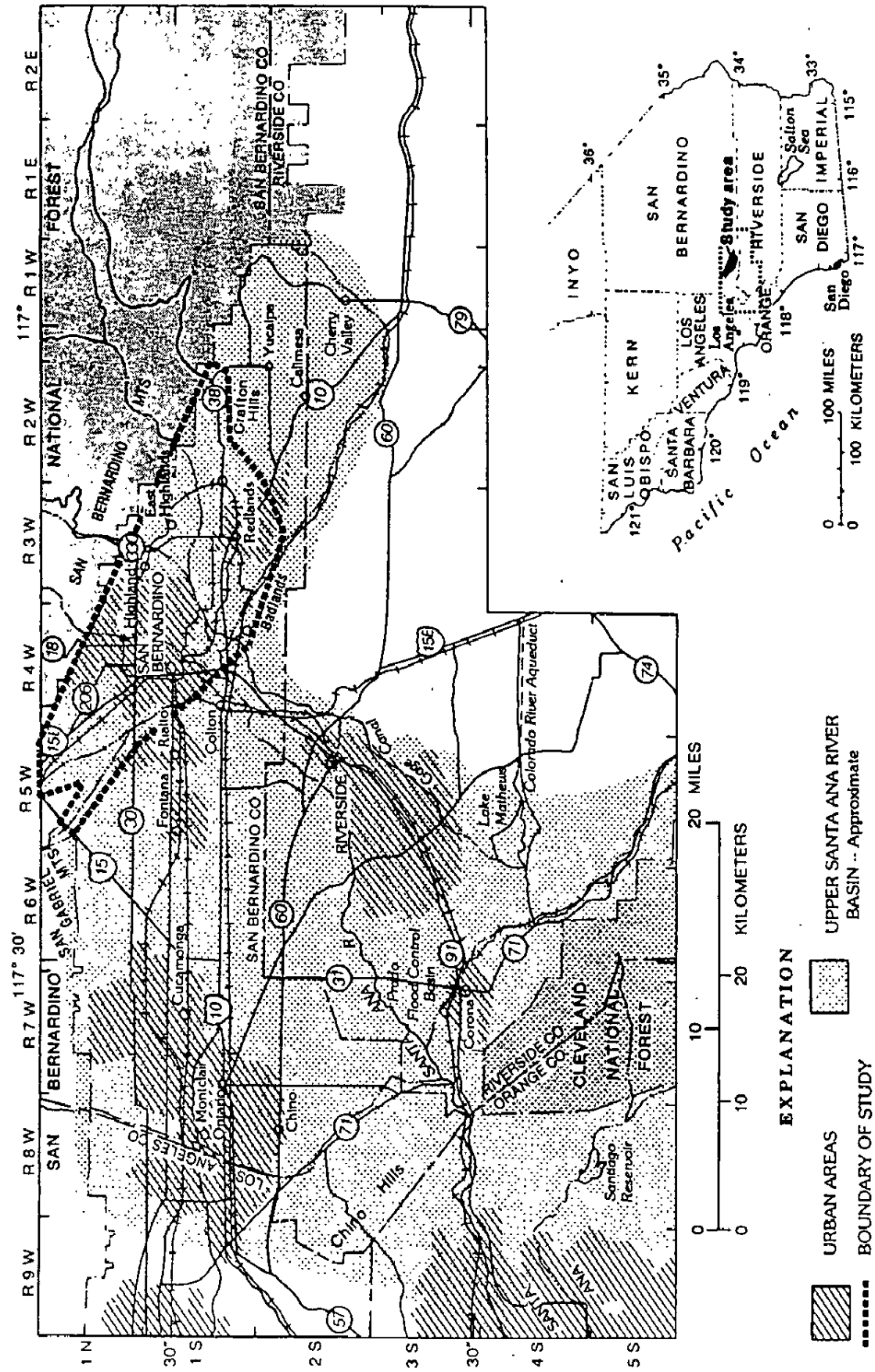

FIGURE 1. Location of Bunker Hill Groundwater Basin, Upper Santa Ana River Valley San Bernardino, California

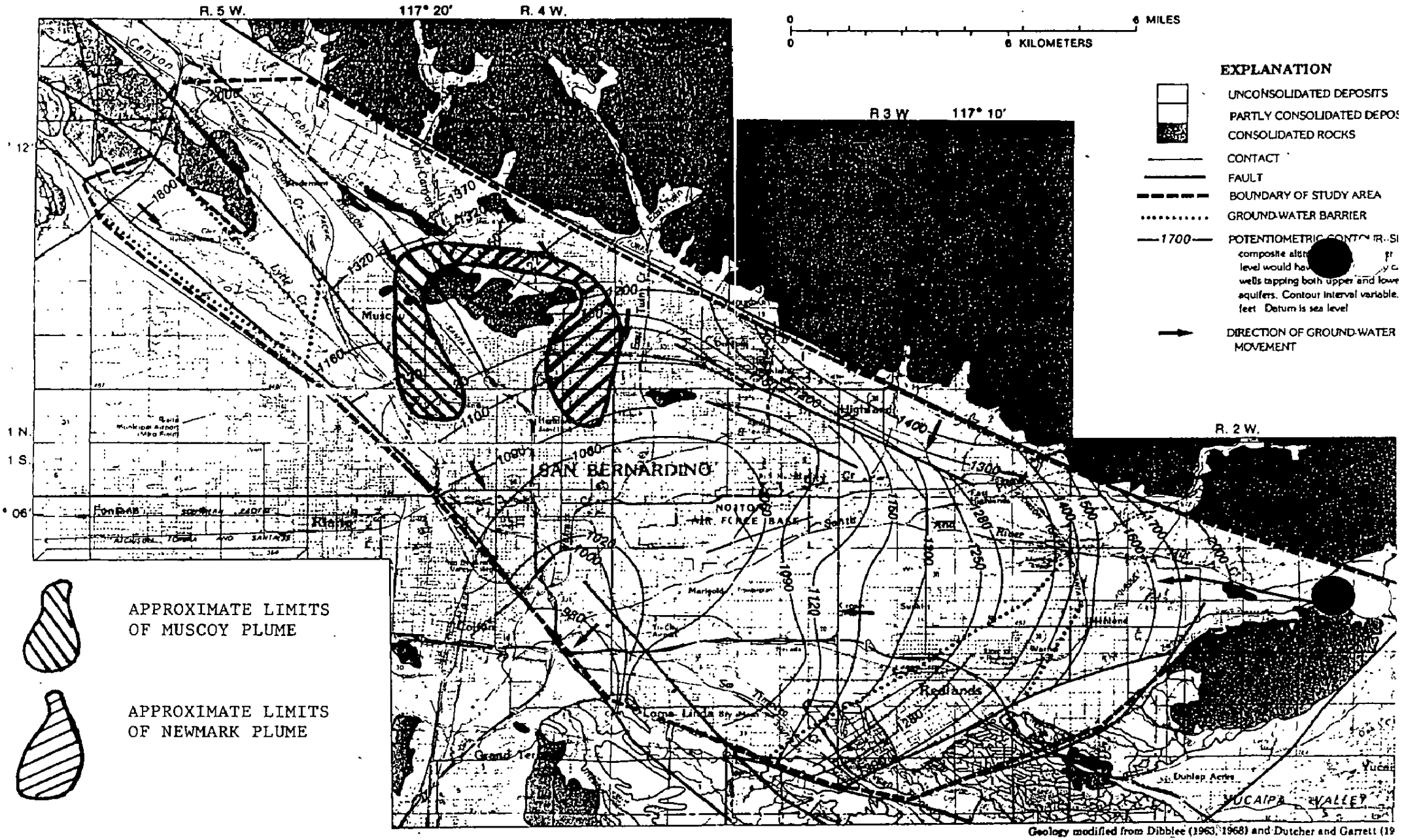

FIGURE 2. Altitude of Groundwater Surface and Direction of Groundwater Flow (1986)

1.2 Description and Background of the Newmark Superfund Site

The primary contaminants of concern at the Newmark Superfund Site are the solvents **perchloroethylene (PCE) and trichloroethylene (TCE)**, which are widely used in a variety of industries, including dry cleaning, metal plating, and machinery degreasing. These organic solvents are in a class of chemicals, known as volatile organic compounds (VOCs), which evaporate (volatilize) readily at room temperature. If large enough amounts of PCE and TCE are spilled or leaked onto the ground, these chemicals can reach the aquifer where they will slowly dissolve into groundwater. As the contaminated water flows away from the source, a plume of contaminated water can spread many miles downstream. Wells within the plume will be pumping contaminated water.

As of 1995, PCE and TCE in concentrations exceeding the drinking water standards of 5 micrograms per liter (parts per billion) have been detected in 20 public water supply wells in northern San Bernardino. The pattern of contamination, defined by sampling monitoring wells and water supply wells throughout the Newmark Superfund Site (see Figure 3), indicates that a release or releases occurred in northwest San Bernardino (approximately in the area of a former military depot known as the San Bernardino Engineering Depot or Camp Ono), and that contaminants have spread more than five miles toward the Santa Ana river to the southeast. A major outcrop of relatively impermeable bedrock (the Shandin Hills) splits the plume of contaminated groundwater into an eastern branch (the Newmark plume) and a western branch (the Muscoy plume). EPA is addressing the leading edges of the plume as two separate Operable Units. The identification, characterization and remediation of the source of contamination will constitute a third Operable Unit. The RI/FS report for the Newmark OU was finalized in March, 1993, and EPA's Regional Administrator signed a Record of Decision for the Newmark OU interim remedy on August 4, 1993. The Newmark OU Remedial Design was initiated in September, 1993, and is expected to be completed in early 1995.

1.3 Description and Background of the Muscoy Plume Operable Unit

The Muscoy Plume OU encompasses a portion of the Bunker Hill Basin aquifer beneath the northern portion of the city of San Bernardino and an unincorporated portion of San Bernardino County known as the Muscoy community. The Muscoy plume is the western lobe of the Newmark Superfund Site groundwater contamination. This contamination has migrated south of Highland Avenue in San Bernardino along a flow path roughly parallel to the Cajon Wash. The Cajon Wash, a major recharge zone of the Bunker Hill groundwater basin, prevents the contaminants from migrating further west and tends to push the contaminants toward the east. The Shandin Hills bedrock outcrop limits the eastern flow of the Muscoy plume. The leading edge of the Muscoy plume arrived at San Bernardino's 19th Street wells in the mid to late 1980's but has not yet reached the wells at 10th Street, approximately one mile to the southeast. At an estimated flow rate of 300 to 500 feet per year, contaminated groundwater would require ten to twenty years to migrate from the 19th Street wells to the 10th Street wellfields.

The EPA placed the Newmark site on the National Priorities List (NPL) in March, 1989. At that time, EPA believed the eastern (Newmark) plume of contamination to be completely separate from the western (Muscoy) plume of groundwater contamination.

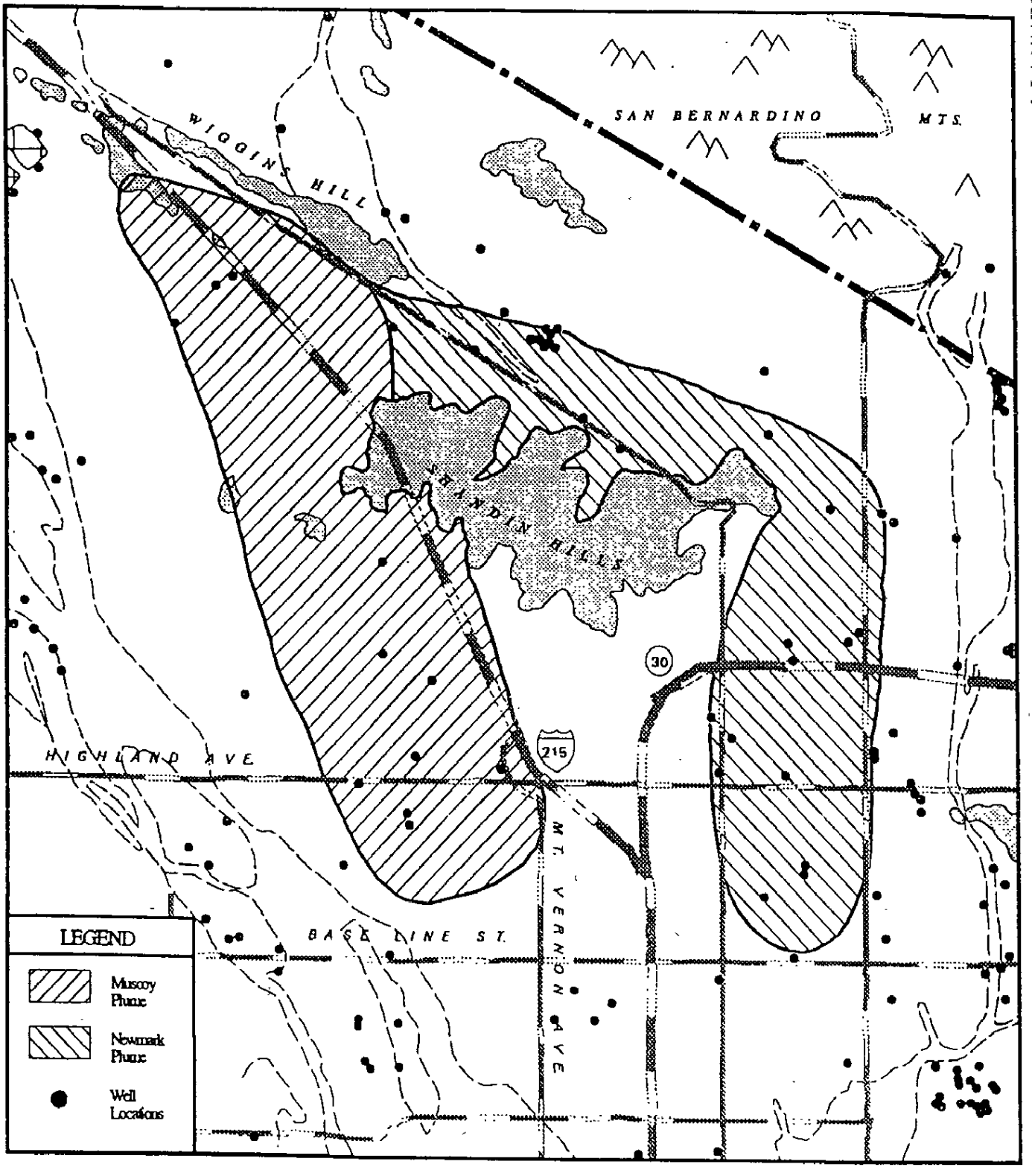

FIGURE 3. Extent of Groundwater Contamination and Well Locations, Newmark Superfund Site - Newmark and Muscoy Plumes

The EPA Remedial Investigation (RI) began in late 1990, focusing entirely on the Newmark plume. Results from the RI showed that the originally suspected source of the Newmark plume (a disposal pit for waste liquids from a former airport) was not the source of the contamination. Additional well drilling in the summer of 1992 traced the groundwater contamination back through a previously undiscovered underground channel flowing from the western (Muscoy) side of the valley. EPA expanded the Newmark Superfund Site Remedial Investigation in September, 1992 to include the Muscoy plume.

Due to EPA's experience with the Newmark plume and to the availability of over ten years of water quality data from state and local groundwater investigations in San Bernardino, EPA was able to expedite the Remedial Investigation of the Muscoy Plume OU. In 1992 all available wells in the vicinity of the Muscoy plume were sampled by EPA. PCE and TCE were the most prevalent contaminants in all of the contaminated wells. Other VOCs were also detected in trace quantities. These results were consistent with water quality samples analyzed by state and local authorities since 1980.

In 1993, EPA recognized that sufficient information had been collected to develop interim action alternatives to control the spread of the Muscoy plume while proceeding with field work to identify the source. The Muscoy Plume OU has the limited objectives of addressing migration at the leading edge of the plume while EPA continues to investigate the source of the contamination. The RI/FS Report for the Muscoy Plume OU was finalized in December, 1994.

2. SITE HISTORY

In 1980, the California Department of Health Services (DHS) initiated a monitoring program in San Bernardino to test for the presence of industrial chemicals in the water from public supply wells. The results of initial tests and of subsequent testing revealed the presence of PCE and TCE contamination in large portions of the groundwater of the Bunker Hill Basin.

Fourteen wells operated by the city of San Bernardino Water Department in the North San Bernardino / Muscoy area were found to contain concentrations of PCE and TCE above the state and federal MCLs of 5 parts per billion (ppb) for both TCE and PCE. The solvents were found in wells scattered around the north, east and west sides of the Shandin Hills. (Figure 3) The affected wells had supplied nearly 25 percent of the water for the city of San Bernardino. As of 1995, a total of thirteen public water supply wells have been contaminated by the solvents in the Newmark plume, and seven water supply wells have been affected in the Muscoy plume.

The cities of San Bernardino, Riverside and other water agencies in the area closely monitor the quality of drinking water delivered to residents. These entities have taken the necessary steps to ensure that the water served to residents meets all federal and state drinking water requirements.

Following investigations by the Santa Ana Regional Water Quality Control Board and California Department of Health Services (now the California EPA Department of Toxic Substances Control), the state provided over $6 million to construct four water treatment systems to protect the public water supply. After years of testing it became apparent that the solvents in the groundwater were continuing to flow south, threatening many more wells operated by San

Bernardino, Riverside and other communities. The state requested federal involvement to address this regional problem.

The state investigations published in 1986 and 1989 both suggested that the widespread contamination in northern San Bernardino probably resulted from numerous small, unidentified sources. The Shandin Hills and nearby hill formations were assumed to separate the eastern (Newmark area) aquifer from the western (Muscoy area) aquifer, making it unlikely that all 14 wells could have been contaminated from a single source. However, continued monitoring of existing water supply wells and monitoring wells constructed by the state established a record of contamination relatively uniform in composition and concentration throughout the area north and east of the Shandin Hills. This pattern strongly suggested a single plume in this area.

Aerial photographic analysis of the Newmark Superfund Site was completed by EPA's Environmental Monitoring Systems Laboratory in September, 1990. This analysis, along with interviews of witnesses, suggested that the primary source of contamination was a suspected solvent disposal pit ("cat pit") on the former site of the private San Bernardino Airport. Waste oil and solvents were disposed of at this site from the late 1950's intermittently through the early 1970's. Several minor activities in different parts of the airport site were also identified as potential waste releases. No other sources could be identified between the disposal site and the closest uncontaminated wells upgradient. The waste disposal pit was also within several hundred feet of the Newmark wellfield (four City of San Bernardino Water Department wells). These wells exhibited the highest concentration of contaminants measured in any wells in the area, nearly 200 µg/l (parts per billion) of PCE.

Based on information obtained during the Remedial Investigation, the San Bernardino Airport site is no longer suspected to be the source of the Newmark plume. It is now believed that the principle source (or sources) lies on the west side of the Shandin Hills and is the likely origin of both the Newmark and Muscoy plumes.

While ongoing investigations attempt to definitively identify the source, EPA determined that the continuing migration of the Muscoy plume could be inhibited through an interim remedial action (the Muscoy Plume OU).

3. ENFORCEMENT ACTIVITIES

The results of the Remedial Investigation and other investigations undertaken by EPA and state agencies indicate that the project lead for the Muscoy Plume OU will remain with EPA.

As explained above, the disposal pits at the former San Bernardino Airport site were originally suspected to be the source of the contamination. Considerable effort was expended on a search for Potentially Responsible Parties (PRPs) while the airport site disposal pits were the suspected source. However, results of the Remedial Investigation reveal that the source of the contamination is more than one mile upgradient of the originally suspected source. No residual contamination was found in the unsaturated zone or the upper portion of the aquifer immediately beneath former disposal pits. The airport site is no longer considered a likely source of the contamination.

The current focus of the PRP search is on the potential sources located to the northwest of the Shandin Hills. These potential sources include the San Bernardino Engineering Depot (a WWII-era army base decommissioned in 1947, commonly known as Camp Ono), a closed county landfill (the Cajon landfill), and subsequent industrial activities at the site of the former Camp Ono.

EPA formally requested detailed information from the Department of Defense (DoD) concerning the operations at the former Camp Ono in 1993 and again in 1994. A partial reply to the earlier request was received November, 1993. In this response, the DoD noted that solvents had been used and disposed of at the base. The designated DoD representative reported that research into EPA's 1994 information request has commenced. The Department of Defense was notified of its potential liability in a General Notice letter sent on December 22, 1993. EPA and DoD (through the Army Corps of Engineers) have been communicating regularly regarding the Newmark Superfund Site throughout 1994. On December 16, 1994, the designated representative of the Department of Defense was sent a copy of the Muscoy Plume Proposed Plan, with a transmittal letter stating that the Muscoy Plume OU was the second OU of the Newmark Superfund Site. EPA noted that the previous General Notice letter sent on December 22, 1993, notified DoD of potential liability for the entire Newmark Superfund Site.

4. HIGHLIGHTS OF COMMUNITY PARTICIPATION

EPA's preferred remedial alternative, as well as four other alternatives were described in EPA's Proposed Plan for the Muscoy Plume OU (December 1994). The Proposed Plan was in the form of a fact sheet and was distributed to all parties (approximately 700) on EPA's mailing list for the Newmark project. The public comment period was extended to more than 5 weeks (38 days) to compensate for the holiday period in December. EPA received no requests for extensions from members of the public. The public comment period closed on January 20, 1995. EPA received approximately 16 comments, with a large proportion relating to source characterization rather than control of the Muscoy plume. These comments and EPA's responses to these comments are summarized in Part III (the Responsiveness Summary) of this ROD.

A press release to announce the release of the Proposed Plan was issued December 16, 1994. The press release and the Proposed Plan Fact Sheet announced that a public meeting to discuss and receive comments on the Muscoy Plume Proposed Plan was scheduled for January 10, 1995. Notice of the public meeting as well as the availability of the Proposed Plan was published in the Inland Empire Sun on December 14, 1994. In addition, several newspaper articles were written about the Remedial Investigation, the Feasibility Study and the Proposed Plan for the Muscoy Plume OU. A map of the Muscoy Plume OU was provided in the Proposed Plan and the above-referenced newspaper articles published maps and described the area that would be impacted by the Muscoy Plume OU.

A public meeting was held in the City of San Bernardino Council Chambers on January 10, 1995, to discuss EPA's preferred alternative and the other alternatives. At this meeting EPA gave a brief presentation regarding the Proposed Plan, answered questions, and accepted comments from members of the public. This meeting was broadcast live on the local cable channel.

EPA expended considerable effort developing strong community relations. A Technical Advisory Committee has been successful in maintaining close communication with local and state agencies. For communication with the local community, three principle mechanisms have been employed: formal presentations (open houses, meetings with organizations and fact sheet distribution), contact with the print and electronic media, and informal discussions with home-owners' associations and individuals.

Three different home-owners' associations, the Muscoy Municipal Advisory Council and several water supply agencies accepted EPA's offer for informal discussions of the project. Drilling around these communities was greatly facilitated by open communication, including distribution of four fact sheets. Presentations were made to the staff and teachers at a local school, and the Project Manager taught the 5th grade class about groundwater and chemical pollution as it relates to the project.

5. SCOPE AND ROLE OF THE OPERABLE UNIT

The interim remedial action for the Muscoy Plume OU represents a discrete element in the overall long-term remediation of groundwater contamination in the San Bernardino area. Since the source of the contamination has not been definitively identified, the final overall plan for the remediation of the entire Newmark Groundwater Contamination Site has not yet been determined. The Muscoy plume constitutes a major portion of the contaminated aquifer and the Muscoy Plume OU interim remedial action will be a significant step toward eventual remediation. EPA does not expect the objectives of this interim action to be inconsistent with, or preclude, any final action for the entire site.

The objectives of the Muscoy Plume OU are:

- To inhibit migration of groundwater contamination into clean portions of the aquifer;
- To protect downgradient municipal supply wells south and southwest of the Shandin Hills;
- To begin to remove contaminants from the groundwater plume for eventual restoration of the aquifer to beneficial uses. (This is a long-term project objective rather than an immediate objective of the interim action.)

The analysis of the No Action option indicates that unless this action is implemented, the contamination will continue to spread to clean areas of the aquifer which are currently important sources of drinking water.

When sufficient information is available on the contaminant source and transport from the source, EPA will review and evaluate various groundwater remediation options for the entire Newmark Superfund Site. It is expected that the Muscoy Plume OU remedy will constitute an integral part of the final remedy.

EPA will continue to monitor aquifer behavior and contaminant transport as part of this interim action. The information gathered will be important in the analysis of a remedy for the entire Newmark Superfund Site.

Table 1. Maximum Concentrations of Volatile Organic Compounds Detected (above 0.5 µg/l detection limit) in Wells in the Muscoy Plume

Compound	Maximum Concentration (µg/l)
1,1 Dichloroethane (DCA)	0.8
cis-1,2-Dichloroethene (DCE)	6
Trichloroethene (TCE)	6
Tetrachloroethene (PCE)	27
Dichlorodifluoromethane (Freon 12)	28
Trichlorofluoromethane (Freon 11)	4

6. SUMMARY OF MUSCOY PLUME OU SITE CHARACTERISTICS

EPA's Remedial Investigation provided critical understanding in three general areas: groundwater flow characteristics, contaminant identification and concentration, and potential routes of exposure.

The Remedial Investigation confirmed that most recharge to the Muscoy Plume OU part of the Bunker Hill Basin originates along the San Bernardino and San Gabriel Mountains to the north via the Cajon Wash along the west. Drinking water wells north and west of the site show that this source is not contaminated. Another important observation was that clay or silt layers that would inhibit vertical contaminant migration were not present in wells near the leading edge of the plume. This indicates that contaminants at any depth in the aquifer would not be prevented from entering water supply wells in the area, regardless of the depth of the water supply well. A groundwater flow model was successfully developed to describe the aquifer behavior and proved to be a useful tool in developing remedial alternatives.

The contaminants identified were predominantly chlorinated solvents. (Table 1) Tetrachloroethene (PCE) was found in all contaminated wells at concentrations less than 30 parts per billion (ppb). Trichloroethene (TCE) was the next most common contaminant, and never exceeded 10 ppb. Other related contaminants of concern, cis-1,2-dichloroethene (DCE) and 1,1-dichloroethane (DCA), were identified at concentrations below drinking water standards. *Chlorofluorocarbons (freons) were also detected.*

Analysis of potential exposure routes during the Remedial Investigation concluded that the only measurable exposure to the VOCs would be through untreated domestic water supply. Several state and EPA investigations failed to identify VOC contamination at the surface or within ten feet of the soil surface anywhere at the Newmark Superfund Site. Consequently, direct contact with VOC's via surface soil is not a possible exposure route. Further EPA investigations examined the potential for volatile chemicals to enter residences through the soil. Direct in-home measurements confirmed EPA calculations that this also is not a possible exposure route. Exposure through untreated domestic water supply is discussed thoroughly in the Site Risk section below.

7. SUMMARY OF SITE RISKS

Baseline risk assessments are conducted at Superfund sites to fulfill one of the requirements of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The NCP (40 CFR Part 300) requires development of a baseline risk assessment at sites listed on the National Priorities List (NPL) under CERCLA. The CERCLA process for baseline risk assessments is intended to address both human health and the environment. However, due to the nature of the contamination at the site and the highly urbanized setting of the Muscoy Plume OU, the focus of the baseline risk assessment was on human health issues rather than environmental issues.

The objective of the baseline risk assessment for the Muscoy Plume OU was to evaluate the human health and environmental risks posed by the contaminated groundwater if it were to be used as a source of drinking water without treatment. The baseline risk assessment

incorporated the water quality information generated during the RI field investigation and sampling program to estimate current and future human health and environmental risks.

The risk assessment was conducted in accordance with EPA guidance including: Guidance for Conducting Remedial Investigation and Feasibility Studies under CERCLA (USEPA, 1988), Risk Assessment Guidance for Superfund, Vol. I Health Evaluation Manual (Part A) and Vol. 2 Ecological Assessment (USEPA, 1989), The Exposure Factors Handbook (USEPA, 1989), and Risk Assessment Guidance for Superfund Human Health Risk Assessment, USEPA Region IX Recommendations (USEPA, 1989).

A risk assessment involves the qualitative and quantitative characterization of potential health effects of specific chemicals on individuals or populations. The risk assessment process comprises four basic steps: 1) hazard identification, 2) dose-response assessment, 3) exposure assessment, and 4) risk characterization. The purpose of each element is as follows:

- Hazard identification characterizes the potential threat to human health and the environment posed by the detected constituents.
- Dose response assessment critically examines the toxicological data used to determine the relationship between the experimentally administered animal dose and the predicted response (e.g., cancer incidence) in a receptor.
- Exposure assessment estimates the magnitude, frequency, and duration of human exposures to chemicals.
- Risk characterization estimates the incidence of or potential for an adverse health or environmental effect under the conditions of exposure defined in the exposure assessment.

Human Health Risk Assessment

The potential for non-carcinogenic health effects was estimated by calculating a hazard index for the sum of all the compounds of potential concern in the Muscoy plume. The health index compares the levels of contaminants in the groundwater with levels that could cause an adverse non-cancer health effect. If the total hazard index reaches 1.0 or above, there may be a concern for potential health risks. The hazard index for the Muscoy Plume OU was less than 0.5, which indicated that non-carcinogenic health effects are negligible.

The risk assessment also estimated the possibility that additional occurrences of cancer will result from exposure to contamination. The background probability of developing cancer from all causes in California is approximately one in four (or 250,000 in a million). An excess cancer risk of 1 in a million means that a person exposed to a certain level of contamination would increase the risk of developing cancer from 250,000 in a million to 250,001 in a million as a result of the exposure. EPA considers excess cancer risks greater than 100 in a million to be unacceptable.

In preparing risk assessments, EPA uses very conservative assumptions that weigh in favor of protecting public health. For example, EPA may assume that individuals consume two liters

of drinking water from wells situated within a contaminant plume every day for a 30-year period, even though typical exposure to the chemical would be far less.

EPA included two potential exposure routes (ways the contamination gets into the body) in the risk assessment:

- drinking the groundwater during residential use; and
- inhaling the chemicals in groundwater as vapors during showering.

Skin contact with contaminated water was also considered but EPA found that it did not pose a significant risk. Results of the RI indicated that direct exposure to volatile organic compounds (VOCs) from surface soil or from water 100 feet below ground was insignificant at this site (see Section 6.0 - Summary of Site Characteristics).

Chemicals of potential concern in the Muscoy Plume OU used in the risk assessment calculations included: PCE, TCE, cis-1,2-Dichloroethene (DCE), and other VOCs detected in at least one well. EPA will continue to monitor the groundwater in the Muscoy Plume OU for any changes that would affect the risk analysis.

The results of the risk assessment indicated that the current contaminant levels in the aquifer of the Muscoy Plume OU would not meet state or federal drinking water standards if this water were to be delivered directly to local residents, without being treated. However, the levels are currently below the concentrations that would pose an unacceptable risk to human health, as defined by CERCLA. If the groundwater were used as a drinking water source without treatment, the chance of developing cancer during a lifetime would increase by as much as 50 in a million. EPA is taking an action at the Muscoy Plume OU in order to meet the drinking water standards (MCLs) even though the risk levels do not exceed 100 in a million.

The baseline risk assessment for the Muscoy Plume OU is presented in the Remedial Investigation and Feasibility Study Report for the Muscoy Plume OU (December 1994).

Environmental Risk Assessment

Given the present developed condition of the site and the major exposure pathway consideration of contaminated groundwater, there was no expectation for significant impact to potential environmental receptors. Urbanization has already replaced habitat potential; therefore, no significant number of receptors appeared to be present. There appeared to be no apparent mechanism for exposure to environmental receptors from contaminated groundwater. Also, there was no indication that future site plans would reinstate habitat and thereby recreate a potential for environmental receptors in the future.

8. DESCRIPTION OF ALTERNATIVES

Development of Alternatives to Meet Project Objectives

Before developing a range of cleanup alternatives for evaluation, EPA identified the objectives of the interim cleanup for the Muscoy Plume OU. All of the alternatives were screened for: 1) effectiveness at protecting human health and the environment, 2) technical feasibility (implementability), and 3) cost. In addition, the alternatives were developed to meet the specific cleanup objectives for the Muscoy Plume OU described previously.

Based on the results of the RI, EPA identified five cleanup alternatives for addressing groundwater contamination of the Muscoy Plume OU. Detailed descriptions of these alternatives are provided in the Muscoy Plume OU RI/FS Report (December, 1994). Rather than including all potential combinations of extraction locations and amounts, the initial screening process identified the most efficient extraction scenario that would meet our objectives. The five alternatives were evaluated based on nine specific criteria: 1) Overall Protection of Human Health and the Environment, 2) Compliance with Applicable or Relevant and Appropriate Requirements (ARARs), 3) Long-term Effectiveness and Permanence, 4) Reduction of Toxicity, Mobility or Volume through Treatment, 5) Short-term Effectiveness, 6) Implementability, 7) Cost, 8) State Acceptance, and 9) Community Acceptance.

With the exception of the **Alternative 1 - No Action**, all of the alternatives involve the extraction of an estimated 6,200 gallons per minute (gpm) of groundwater near the leading edge of the plume for a period of 30 years. The actual design capacity of the extraction and treatment facilities will be determined during the Remedial Design phase based on the latest refined groundwater information and modeling. The RI/FS Report analysis indicated that the final extraction rate is expected to be within the range of 5,000 gpm to 7,000 gpm. Individual wells would pump from 800 to 2,000 gpm, the range for a typical city drinking water well.

A computer model was used to determine that these extraction rates would result in effective inhibition of plume migration and optimal contamination removal for this interim action. With the exception of **Alternative 1 - No Action**, all of the alternatives would involve the construction and operation of a VOC treatment system, construction and sampling of additional monitoring wells, and analysis of any changes in the current operations of nearby public water supply wells.

During the first three years after issuance of the ROD, the remedy would proceed to the remedial design and initial implementation stages. EPA must plan, build the equipment and test it to make sure it functions properly.

ALTERNATIVE 1: No Action

This alternative serves as a baseline to compare other alternatives. This alternative is evaluated to determine the risks that would be posed to public health and the environment if no action were taken to treat or contain the contamination. The **No Action Alternative** would involve only groundwater monitoring; no additional cleanup activities would be conducted. The cost of constructing the necessary monitoring wells and sampling them over 30 years would be approximately $2.2 million (present net worth).

ALTERNATIVE 2: Extract/Treat(Granular Activated Carbon)/Public Water Agency

Extraction

Alternative 2 involves the extraction of an estimated 6,200 gpm of contaminated groundwater placed at the leading edge of the Muscoy plume. The actual design capacity of the extraction and treatment facilities will be determined during the Remedial Design phase based on the latest refined groundwater information and modeling. The extraction wells would be located to inhibit most effectively the migration of the contaminant plume.

Treatment

The extracted groundwater would be transmitted via underground piping to a Granular Activated Carbon (GAC) treatment plant. EPA assumed that an entirely new treatment plant would be constructed near the extraction system and near a major distribution system pipeline. It may be possible to use an existing treatment plant site with construction of pipeline to the plant and from the plant to the distribution pipeline. Note that Alternative 3, involving treatment by air stripping, is considered by EPA to be equivalent to Alternative 2, and may be substituted for all or part of Alternative 2 during the design phase of the project.

Transfer of Treated Water

The treated water would meet all applicable or relevant and appropriate drinking water standards for VOCs and would be piped to a public water supply agency for distribution. Groundwater monitoring wells would be installed to evaluate the effectiveness of the remedial action. Following approximately 2 to 3 years for design and construction, this system would operate for 30 years. Operation of nearby public water supply wells are not expected to interfere with this remedy, although any significant changes in operations would be analyzed to determine the effect on this cleanup action. EPA will conduct a formal assessment of the project effectiveness every five years.

The present net worth cost of Alternative 2, including capital costs and thirty years of operation and maintenance, is estimated at $26,000,000.

ALTERNATIVE 3: Extract/Treat(Air Stripping with Emission Control)/Public Water Agency

Alternative 3 involves the same extraction system, transfer of treated water to a public water agency and monitoring design as Alternative 2. Alternative 3 differs from Alternative 2 in the treatment of the extracted groundwater to remove VOCs to meet applicable or relevant and appropriate drinking water standards for VOCs. In Alternative 3, the extracted contaminated water would be treated by air stripping with emission control to meet the South Coast Air Quality Management District's requirement for best available control technology. Currently, vapor-phase granular activated carbon meets this requirement, and EPA used this technology for cost and effectiveness analysis. New emissions control technologies developed prior to the final design could be considered if they meet the air quality requirement. Air stripping is essentially equal to GAC (Alternative 2) in effectiveness, technical feasibility and the remaining criteria.

The present net worth cost of Alternative 3, including capital costs and thirty years of operation and maintenance, is estimated at $21,500,000.

ALTERNATIVE 4: Extract/Treat (Advanced Oxidation - Peroxide/Ozone)/ Public Water Agency

Alternative 4 involves the same extraction, transfer of treated water to a public water agency and monitoring design as Alternative 2. The extracted water would be treated for VOCs using an advanced oxidation process that uses peroxide and ozone to destroy (oxidize) the contaminants (rather than transferring the contaminants to a carbon filter). The treated water would meet all applicable or relevant and appropriate drinking water standards for VOCs and would be piped to a public water supply agency. Groundwater monitoring wells would be installed to evaluate the effectiveness of the action.

The present net worth cost of Alternative 4, including capital costs and thirty years of operation and maintenance, is estimated at $32,000,000.

ALTERNATIVE 5: Extract/Treat (GAC or Air Stripping)/Return to the Aquifer via Reinjection.

Alternative 5 involves the same extraction, treatment and monitoring designs as Alternative 2 (including the option to use either GAC or air stripping to treat the extracted water for VOCs). The water would be returned to the aquifer in reinjection wells downgradient from the extraction wells. The treated water would meet state reinjection standards before being returned to the aquifer.

The present net worth cost of Alternative 5, including capital costs and thirty years of operation and maintenance, is estimated at $30,800,000.

9. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

A comparative analysis of the alternatives against the nine evaluation criteria set forth in the NCP at 40 CFR 300.430 (e)(9)(iii) is presented in this section.

No Action versus the Nine Criteria. Clearly, Alternative 1 would not be effective in the short- and long-term in protecting human health and the environment as it does not provide for removing any contaminants from the aquifer, for inhibiting further downgradient contaminant plume migration, or for reducing the toxicity, mobility and volume of contaminants through treatment. Implementing the no-action alternative would be simple and inexpensive since it involves only groundwater monitoring. As indicated by the baseline risk assessment presented in the RI Report, Alternative 1 could pose carcinogenic risk if a person were exposed to the untreated groundwater through the domestic water supply, although the risk is below the 100 in a million excess risk level (10^{-4}) which EPA considers generally unacceptable. The current contaminant level would not meet state or federal drinking water standards if this water were to be delivered directly to local residents without treatment. Loss of a valuable water resource from continued degradation of the aquifer is a major concern for the state and the public.

Overall Protection of Human Health and the Environment, Short Term Effectiveness and Long Term Effectiveness. Alternatives 2, 3, 4 and 5 have the same effectiveness in the short and long term in reducing the risk to human health and the environment by removing contaminants from the aquifer, by inhibiting further downgradient contaminant migration, and by reducing the toxicity, mobility and volume of contaminants in the aquifer.

Reduction of Toxicity, Mobility and Volume through Treatment. The VOC treatment technologies used in Alternatives 2, 3 and 5 (either air stripping with emission control (e.g., vapor-phase GAC adsorption) or liquid phase GAC adsorption) are technically feasible and effective in meeting ARARs for VOCs in the extracted and treated groundwater. Treatment of the extracted contaminated groundwater via air stripping with vapor-phase GAC adsorption or via liquid phase GAC adsorption would reduce substantially the toxicity and mobility of contaminants in the aqueous phase. The adsorption of contaminants onto the GAC would reduce the volume of contaminated media. However, a substantially larger quantity of contaminated GAC media would be generated with either air stripping with vapor-phase GAC or liquid-phase GAC systems compared to perozone oxidation (which is a destructive technology) followed by either air stripping with vapor-phase GAC adsorption or liquid-phase GAC. This contaminated GAC would require disposal or regeneration. During the design phase, an alternative emission control technology will be tested to eliminate the need for vapor-phase GAC while meeting the Best Available Control Technology requirement.

Treatment of the extracted contaminated groundwater via perozone oxidation in Alternative 4 would destroy greater than 90 percent of the VOCs, and generate a smaller quantity of contaminated GAC media compared to the conventional technologies alone. VOC treatment using perozone oxidation has only been tested and applied in pilot-scale/limited applications, and limited O&M data are available. Concern has been expressed over the day-to-day reliability of this innovative technology at large-scale application for drinking water supply treatment. Incomplete oxidation can lead to the formation of by-products such as formaldehyde which would also need to addressed. The reliability concerns for large-scale applications, coupled with the uncertainties associated with design, capital and operational costs and with the fact that a public water supply agency will be receiving the treated water, all combine to make Alternative 4 less preferable than Alternatives 2, 3 and 5 which propose using liquid phase GAC or air stripping for VOC treatment.

Compliance with ARARs. As discussed in the ARARs section (Section 10) of this ROD, since this remedial action is an interim action, there are no chemical-specific ARARs for aquifer cleanup for any of the alternatives. For Alternatives 2 through 4, the chemical-specific ARARs for the treated water from the VOC treatment plant at this site are the federal and state drinking water standards for VOCs set forth in Table 2. Alternative 5 must meet the standards set forth in Table 2 as well as state reinjection standards. Alternatives 2, 3, and 5 are expected to meet these ARARs for the treated water. There is some uncertainty regarding the ability of Alternative 4 to meet these ARARs because perozone has not been used to treat such high concentrations of VOCs at such high flow rates. Therefore, there is the potential for not meeting chemical-specific ARARs unless the air stripping or liquid-phase GAC unit following the perozone system is a redundant treatment system (which would add substantially to the cost).

Implementability. Technically and administratively, Alternatives 2, 3, and 5 could be implemented, although the cooperation of a public water supply agency would be required for implementation of Alternatives 2 and 3. The technologies considered for groundwater monitoring, extraction, and conveyance are proven and have been applied extensively. For Alternative 5, the availability of an appropriate on-site location for reinjection of extracted and treated groundwater would need to be addressed.

State and Public Acceptance. Based on comments received during the public comment period, the public generally expressed support for Alternatives 2 through 5, although reservations were expressed about alternatives 3, 4 and 5. EPA received comments from water agencies in the area specifically in support of the end use aspects of alternatives 2 and 3. Comments received during the public comment period along with EPA responses are presented in Part III of this ROD, the Responsiveness Summary. In a letter dated March 21, 1995, the State of California (Cal-EPA) concurred with EPA's selected remedy for the Muscoy Plume OU.

Cost. The estimated total present worth of Alternatives 2, 3 and 5 ranges from $21,500,000 to $30,800,000. The total present worth cost for Alternative 4 is $32,000,000. For alternatives 2, 3 and 4, some of these costs are expected to be offset by the water supply agencies which accept the treated water. These overall project costs do not take into account the value of utilizing the groundwater resource directly as opposed to recharging the water to the aquifer to be eventually pumped to the surface again prior to use (Alternative 5).

The GAC treatment system already operating at the San Bernardino Municipal Water Department's facility at 19th Street and California Avenue may be incorporated into this action and would provide significant cost savings. Construction of pipeline to a distribution system capable of accepting the full volume of treated water would be required.

Selected Remedy.

EPA's comparative analysis of the remedial alternatives against the nine evaluation criteria concluded that Alternative 2 (extraction, treatment by GAC and transfer to public water supply agency) most fully meets the nine criteria. Accordingly, EPA has selected Alternative 2 as the interim remedial action for the Muscoy Plume OU. Alternative 3, involving treatment by air stripping, is considered by EPA to be equivalent to Alternative 2, and may be substituted for all or part of Alternative 2 during the design phase of the project. In addition, EPA recognizes the need for cooperation from a public water supply agency to implement alternatives 2 or 3. Consequently, EPA selects Alternative 5 (extraction, treatment and reinjection into the aquifer) as a contingency if water supply agencies are unable to accept all of the treated water. Section 11 of the ROD provides a detailed discussion of the major components of the selected remedy.

10. APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

This section discusses Applicable or Relevant and Appropriate Requirements (ARARs) for the selected remedy for the Muscoy Plume OU. Section 121(d) of CERCLA requires that remedial actions attain a level or standard of control of hazardous substances which complies with ARARs of federal environmental laws and more stringent state environmental and facility siting laws. Only state requirements that are more stringent than federal ARARs, and are legally enforceable and consistently enforced may be ARARs.

An ARAR may be either "applicable", or "relevant and appropriate", but not both. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300, defines "applicable" and "relevant and appropriate" as follows:

> Applicable requirements are those cleanup standards, standards of control, or other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable. "Applicability" implies that the remedial action or the circumstances at the site satisfy all of the jurisdictional prerequisites of a requirement.
>
> Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and that are more stringent than federal requirements may be relevant and appropriate.

On-site CERCLA actions must comply with the substantive requirements of all ARARs. Off-site activities must comply with both substantive and administrative requirements of all applicable laws. Substantive requirements are requirements that apply directly to actions or conditions in the environment. Examples include quantitative health or risk-based standards for contaminants. Administrative requirements are those mechanisms that assist in the implementation of the substantive requirements (such as reporting, record keeping, and permit issuance), but do not in and of themselves define a level or standard of control. (See 55 Fed. Reg. 8756).

ARARs fall into three broad categories, based on the manner in which they are applied at a site. These categories are as follows:

Chemical-Specific ARARs. Chemical-specific ARARs are health- or risk-based concentration limits, numerical values, or methodologies for various environmental media (i.e., groundwater, surface water, air, and soil) that are established for a specific chemical that may be present in a specific media at the site, or that may be discharged to the site during remedial activities. These

ARARs set limits on concentrations of specific hazardous substances, pollutants, and contaminants in the environment. Drinking water maximum contaminant levels (MCLs) are examples of chemical-specific ARARs.

Location-Specific ARARs. Location-specific ARARs are federal and state restrictions placed on the concentration of a contaminant or on activities to be conducted because they are in a specific location. Examples of restricted locations include flood plains, wetlands, historic places, and sensitive ecosystems or habitats.

Action-Specific ARARs. Action-specific ARARs are technology- or activity-based requirements which determine how a remedial action must be performed. Examples are Resource, Conservation and Recovery Act (RCRA) regulations for hazardous waste treatment, storage or disposal.

Neither CERCLA nor the NCP provides across-the-board standards for determining whether a particular remedy will result in an adequate cleanup at a particular site. Rather, the process recognizes that each site will have unique characteristics that must be evaluated and compared to those requirements that apply under the given circumstances. Therefore, ARARs are identified on a site-specific basis from information about specific chemicals at the site, specific features of the site location, and actions that are being considered as remedies.

The following section outlines the ARARs that apply to the interim remedial action at this site:

10.1 Chemical-Specific ARARs

The chemical-specific ARARs for the contaminants of concern at the Muscoy Plume OU are set forth in Table 2 and discussed in the following sections.

10.1.1 Federal Drinking Water Standards

Safe Drinking Water Act (SDWA), 42 U.S.C. S300f et seq., National Primary Drinking Water Regulations, 40 CFR Part 141.

Federal MCLs and MCLGs

EPA has promulgated Maximum Contaminant Levels (MCLs) under the Safe Drinking Water Act (SDWA) to protect public health from contaminants that may be found in drinking water sources. Although these requirements are only applicable at the tap for water provided directly to 25 or more people or which will be supplied to 15 or more service connections, they are relevant and appropriate to water that is a current or potential source of drinking water. Because the treatment plant effluent from the Muscoy Plume OU is a potential source of drinking water, EPA has determined that the federal MCLs for the VOCs and any more stringent State of California MCLs for these VOCs are relevant and appropriate to the treatment plant effluent. In accordance with NCP section 300.430(e)(2)(i)(B), EPA has also concluded that non-zero Maximum Contaminant Level Goals (MCLGs) are also relevant and appropriate to treatment plant effluent from the Muscoy Plume OU which may be served as drinking water.

The Muscoy Plume OU is an interim remedial action designed primarily to inhibit the

spread of contamination. Consequently, chemical-specific requirements for the ultimate cleanup of the aquifer, which would be ARARs for a final remedy, are not ARARs for this interim action. (See 55 Fed. Reg. 8755.)

Under Alternatives 2 and 3, EPA will transfer the treated groundwater to a public water supply agency. EPA considers the subsequent serving of the water by the public supply agency (at the tap) to be an off-site, post-remedy activity. Consequently, if the treated water is served as drinking water, all legal requirements for drinking water in existence at the time the water is served will have to be met. Since these requirements are not ARARs, they are not "frozen" as of the date of the ROD. Rather, they can change over time as laws and regulations applicable to drinking water change.

10.1.2 State Drinking Water Standards

California Safe Drinking Water Act, Health and Safety Code, §4010 et seq., California Code of Regulations, Title 22, Division 4, Chapter 15, §64401 et seq.

California Maximum Contaminant Levels (MCLs): 22 CCR 64444.5

The State of California has established drinking water standards for sources of public drinking water, under the California Safe Drinking Water Act, Health and Safety Code Sections 4010 et seq. California MCLs for VOCs are set forth at 22 CCR 64444.5. Several of the state MCLs are more stringent than federal MCLs. In these cases, EPA has determined that the more stringent state MCLs for VOCs are relevant and appropriate for the treatment plant effluent from the Muscoy Plume OU interim remedy. The VOCs for which there are more stringent state standards include cis-1,2-dichloroethene (DCE). There are also some chemicals where state MCLs exist but there are no federal MCLs. EPA has determined that these state MCLs are relevant and appropriate for the treated water prior to discharge or delivery to the water purveyor. The VOCs for which there are no federal MCLs but for which state MCLs exist include 1,1-dichloroethane (DCA).

California Secondary Drinking Water Standards (SDWS): 22 CCR 64471

The State of California has also promulgated Secondary Drinking Water Standards (SDWS) applicable to public water system suppliers, which address the aesthetic characteristics of drinking water. See 22 CCR §64471. Although California SDWS are not applicable to non-public water system suppliers, the California SDWS are relevant and appropriate to the Muscoy Plume OU interim action if the treated water is transferred to a public water supply agency for distribution. It should be noted that federal SDWS have not been identified as ARARs for this action because they are not enforceable limits and are intended as guidelines only. In summary, if the treated water is to be served as drinking water, the treated water at the point of delivery must meet the California SDWS for the contaminants of concern at the Muscoy Plume OU. If the treated water is recharged or (temporarily) discharged to surface waters, the water will not be required to meet State SDWS.

Table 2. Chemical -Specific Applicable or Relevant and Appropriate Requirements at the Muscoy Plume Operable Unit for Treated Water Transferred to Public Water Supply Agency

Compound	ARAR (µg/l)	ARAR (Regulation)
1,1 Dichloroethane (DCA)	5	California MCL
cis-1,2-Dichloroethene (DCE)	6	California MCL
Trichloroethene (TCE)	5	Federal MCL
Tetrachloroethene (PCE)	5	Federal MCL
Dichlorodifluoromethane (Freon 12)	--	--
Trichlorofluoromethane (Freon 11)	150	California MCL

Notes:

MCL = Maximum Contaminant Level
"--" indicates that no non-zero MCL, MCLG or SDWS has been promulgated

10.2 Location-Specific ARARs

No special characteristics exist in the Muscoy Plume OU to warrant location-specific requirements. Therefore, EPA has determined that there are no location-specific ARARs for the Muscoy Plume OU.

10.3 Action-Specific ARARs

The action-specific ARARs for the Muscoy Plume OU interim remedy are as follows:

10.3.1 Air Quality Standards

Clean Air Act, 42 U.S.C. §7401 et seq.; California Health & Safety Code §39000 et seq.

South Coast Air Quality Management District Rules 401, 402, 403, 1301-13, 1401

The Muscoy Plume OU alternative treatment of VOCs by air stripping, whereby the volatile chemical compounds are emitted to the atmosphere, triggers action- specific ARARs with respect to air quality.

The Clean Air Act, 42 U.S.C. §7401 et seq., and California Health & Safety Code §39000 et seq., regulate air emissions to protect human health and the environment, and are the enabling statutes for air quality programs and standards. The substantive state and federal ambient air quality standards are implemented primarily through Air Pollution Control Districts. The South Coast Air Quality Management District (SCAQMD) is the district regulating air quality in the San Bernardino area.

The SCAQMD has adopted rules that limit air emissions of identified toxics and contaminants. The SCAQMD Regulation XIV, consisting of Rule 1401, on new source review of carcinogenic air contaminants is applicable for the Muscoy Plume OU. SCAQMD Rule 1401 requires that best available control technology (T-BACT) be employed for new stationary operating equipment, so the cumulative carcinogenic impact from air toxics does not exceed the maximum individual cancer risk limit of ten in one million (1×10^{-5}). EPA has determined that this T-BACT rule is applicable for the Muscoy Plume OU because carcinogenic compounds such as PCE and TCE are present in groundwater, and release of these compounds to the atmosphere may pose health risks exceeding SCAQMD requirements. The substantive portions of SCAQMD Regulation XIII, comprising Rules 1301 through 1313, on new source review are also applicable to the Muscoy Plume OU.

The SCAQMD also has rules limiting the visible emissions from a point source (Rule 401), prohibiting discharge of material that is odorous or causes injury, nuisance or annoyance to the public (Rule 402), and limiting down-wind particulate concentrations (Rule 403). EPA has determined that these rules are also applicable to the Muscoy Plume OU interim remedy.

10.3.2 Water Quality Standards for Reinjection to the Aquifer

If any treated water is reinjected to the aquifer, the treated water must meet all state and

federal action-specific ARARs for such reinjection. The ARARs applicable to reinjection (Alternative 5) are as follows:

Federal Reinjection Standards

Federal Underground Injection Control Regulations: 40 CFR 144.12 - 144.13

The Safe Drinking Water Act, 42 U.S.C. §300f et seq., provides federal authority over injection wells. The Federal Underground Injection Control Plan, codified at 40 C.F.R. Part 144, prohibits injection wells such as those that would be located at the Muscoy Plume OU from (1) causing a violation of primary MCLs in the receiving waters and (2) adversely affecting the health of persons. 40 C.F.R. §144.12. Section 144.13 of the Federal Underground Injection Control Plan provides that contaminated ground water that has been treated may be reinjected into the formation from which it is withdrawn if such injection is conducted pursuant to a CERCLA cleanup and is approved by EPA. 40 C.F.R. §144.13. These regulations are applicable to any Muscoy Plume OU treated water that is reinjected into the aquifer.

Resource Conservation and Recovery Act §3020, 42 U.S.C. §6939b

Section 3020 of the Resource Conservation and Recovery Act (RCRA) is also applicable to the Muscoy Plume OU interim action. This section of RCRA provides that the ban on the disposal of hazardous waste into a formation which contains an underground source of drinking water (set forth in Section 3020(a)) shall not apply to the injection of contaminated groundwater into the aquifer if: (i) such injection is part of a response action under CERCLA; (ii) such contaminated groundwater is treated to substantially reduce hazardous constituents prior to such injection; and (iii) such response action will, upon completion, be sufficient to protect human health and the environment. RCRA Section 3020(b).

State Reinjection Standards

State Water Resources Control Board Resolution 68-16.

State Water Resources Control Board Resolution No. 68-16, which is incorporated in the Santa Ana Regional Water Quality Control Board's Water Quality Control Plan for the Santa Ana River (and specific Bunker Hill sub-basins), is applicable to the Muscoy Plume OU interim action to the extent that treated water is reinjected into the aquifer. Resolution 68-16 requires maintenance of existing state water quality unless it is demonstrated that a change will benefit the people of California, will not unreasonably affect present or potential uses, and will not result in water quality less than that prescribed by other state policies.

The EPA Region IX Regional Administrator's decision in the matters of George Air Force Base and Mather Air Force Base (July 9, 1993) sets forth a balancing process to be used on a case-by-case basis to determine reinjection standards for treated groundwater under Resolution 68-16. This process requires that the following three factors be balanced in order to determine the permitted discharge level: (1) site-specific considerations, including the hydrogeologic conditions at the site, the contaminants discharged, the quality of the receiving water and the designated beneficial uses of the receiving water; (2) treatment technologies; and (3) cost.

Based upon the balancing process set forth in this decision and on a site-specific analysis of the Muscoy Plume OU, EPA has concluded that the substantive reinjection standard for PCE, DCE, TCE, and DCA at the Muscoy Plume OU will be 0.5 ppb on a monthly median basis for each compound. This conclusion is based on data gathered over the last several years at existing state-funded groundwater treatment plants operating at the leading edge of the contaminant plumes of the Newmark Superfund Site. This site-specific information shows that contaminant levels in the groundwater remain within a range that has been consistently treated to below 0.5 ppb TCE/PCE/DCE/DCA using conventional treatment technologies (Granular Activated Carbon and Air-Stripping). The cost, operating and water quality data from these existing treatment plants leads EPA to believe that the 0.5 ppb level can be effectively and economically attained on a monthly median basis assuming essentially identical conditions in the Muscoy Plume remedial action. EPA's analysis relies on data from the existing treatment plants and assumes that EPA will be reinjecting the treated water into relatively clean groundwater at or near the edge of the contaminant plume.

Based on data from existing treatment plants as well as industry-wide treatability studies, EPA has concluded that neither freon 11 nor freon 12 can be treated effectively and economically by liquid-phase or vapor-phase granular activated carbon. More importantly, EPA's Risk Assessment for this Operable Unit shows no increased risk to human health and the environment from freon at this site. EPA has concluded that the reinjection standards for freon 11 is the MCL for freon 11 (150 ppb). It should be noted that the maximum concentration of freon 11 and freon 12 detected in the Muscoy Plume investigation area was 4 ppb for freon 11 and 28 ppb for freon 12.

10.3.3 Water Quality Standards for Temporary Discharges to Surface Water

National Pollutant Discharge Elimination System Program (NPDES)

EPA anticipates that there may be incidental, short-term discharges of groundwater to the San Bernardino County flood control channel or to the City of San Bernardino storm drains during certain remedial activities (for example, during construction of the groundwater extraction system, the VOC treatment plant, and the monitoring wells, during groundwater sampling, and during system maintenance). The ARAR for any groundwater that is discharged, on a short-term basis, to surface waters is the National Pollutant Discharge Elimination System (NPDES) Program which is implemented by the Santa Ana Regional Water Quality Control Board (SARWQCB). Based on the waste discharge limitations adopted by the SARWQCB in Order No. 91-63-043, EPA has determined that groundwater that will be discharged, on a short-term basis, to surface waters on-site must meet state or federal MCLs (whichever is more stringent) for PCE, TCE, DCE, and DCA.

10.3.4 Hazardous Waste Management

California Hazardous Waste Control Act, Health & Safety Code, Division 20, Chapter 6.5

The State of California has been authorized to enforce its own hazardous waste regulations (California Hazardous Waste Control Act) in lieu of the federal RCRA program administered by

the EPA. Therefore, state hazardous waste regulations in the California Code of Regulations (CCR), Title 22, Division 4.5 are now cited as ARARs instead of the federal RCRA regulations.

Under 22 CCR Section 66261.31, certain "spent" halogenated solvents, including TCE and PCE, are listed hazardous wastes (RCRA waste code F002). Although TCE, PCE and certain other halogenated solvents are the contaminants of concern in the groundwater at the Muscoy Plume OU, the source of these contaminants has not yet been determined, and the contaminants cannot therefore be definitively classified as listed RCRA hazardous wastes. However, the contaminants are sufficiently similar to listed RCRA hazardous wastes that EPA has determined that portions of the state hazardous waste regulations are relevant and appropriate to the Muscoy Plume OU interim action.

VOC Treatment Plant Requirements: 22 CCR §§ 66264.14, 66264.18, 66264.25, 66264.600-.603, and 66264.111-.115

The substantive requirements of the following general hazardous waste facility standards are relevant and appropriate to the VOC treatment plant: 22 CCR Section 66264.14 (security requirements), 22 CCR Section 66264.18 (location standards) and 22 CCR Section 66264.25 (precipitation standards).

In addition, an air stripper or GAC contactor would qualify as a RCRA miscellaneous unit if the contaminated water constituted RCRA hazardous waste. EPA has determined that the substantive requirements for miscellaneous units set forth in Sections 66264.600 -.603 and related substantive closure requirements set forth in 66264.111-.115 are relevant and appropriate for the air stripper or GAC contactor. The miscellaneous unit and related closure requirements are relevant and appropriate because the water is similar to RCRA hazardous waste and the air stripper or GAC contactor appear to qualify as miscellaneous units. Consequently, the air stripper or GAC contactor should be designed, operated, maintained and closed in a manner that will ensure the protection of human health or the environment.

Certain other portions of the state's hazardous waste regulations are considered to be relevant but not appropriate to the VOC treatment plant. EPA has determined that the substantive requirements of Section 66264.15 (general inspection requirements), Section 66264.15 (personnel training) and Sections 66264.30-66264.56 (Preparedness and Prevention and Contingency Plan and Emergency Procedures) are relevant but not appropriate requirements for this treatment system. EPA has made this determination because the treatment plant will be required to have health and safety plans and operation and maintenance plans under CERCLA that are substantively equivalent to the requirements of Sections 66264.15, 66264.30-66264.56.

Land Disposal Restrictions: 22 CCR §66268

The land disposal restrictions (LDR) set forth in 22 CCR Section 66268 are relevant and appropriate to on-site disposal of contaminated groundwater on land. The remedial alternatives presented do not include on-site land disposal of untreated groundwater, except as may occur through activities incidental to the remedial activity, such as purging monitoring wells. Any water discharged to land must meet state or federal MCLs, whichever is more stringent, prior to discharge. Such water would not constitute a RCRA hazardous waste and would therefore not trigger LDRs.

The LDRs set forth in 22 CCR 66268 are also relevant and appropriate to the on-site disposal of spent carbon on land. These restrictions would be applicable if the spent carbon contains sufficient quantities of hazardous constituents to render it a characteristic hazardous waste. However, the remedial alternatives presented do not contemplate on-site disposal of spent carbon on land and are therefore unlikely to trigger LDRs.

Storage Requirements: 22 CCR §§66262.34, 66264.170 - 66264.178

The container storage requirements in 22 CCR Sections 66264.170 -.178 are relevant and appropriate for the on-site storage of contaminated groundwater or spent carbon over 90 days. The substantive requirements of 22 CCR Section 66262.34 are relevant and appropriate for the on-site storage of contaminated groundwater or spent carbon for less than 90 days. These requirements would be applicable if the contaminated groundwater or the spent carbon contained sufficient quantities of hazardous constituents to render them characteristic hazardous wastes.

10.4 Other Performance Standards

The NCP authorizes EPA and the state to identify advisories, criteria, guidance or proposed standards to-be-considered (TBCs) that may be helpful or useful in developing CERCLA remedies. NCP, 40 CFR Sections 300.400(g)(3) and 300.430(b)(9). Such TBCs are identified in the RI/FS and may be selected by EPA as requirements for the remedial action in the ROD.

EPA has determined that certain substantive standards for the construction of public water supply wells published by the State of California (the California Water Well Standards) and identified as TBCs in the RI/FS should be requirements for the Muscoy OU interim remedy. While these standards have not been specifically promulgated as an enforceable regulation and are therefore not ARARs, all groundwater facilities designed, located and constructed to produce drinking water must be constructed in accordance with these standards. Since the Muscoy Plume OU interim remedy involves transfer of the treated water to the public water supply agency, EPA has determined that the remedial action will comply with substantive Water Well Standards for construction of water supply wells, such as sealing the upper annular space to prevent surface contaminants from entering the water supply. Standards for location of the extraction wells are not appropriate, since the effectiveness of the remedial action is dependent upon the well locations. Additionally, wells constructed solely for treatment and reinjection with no delivery to the public supply water system will not be subject to these water well construction standards.

11. THE SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the detailed analysis of the alternatives, and public comments, EPA has determined that Alternative 2: extraction, treatment of VOCs by liquid phase GAC (or air stripping with best available control technology for emissions), and conveyance to a public water supply agency, is the most appropriate interim remedy for the Muscoy Plume OU. If the public water supply agency does not accept any or all of the treated water, then Alternative 5: extraction, treatment of VOCs, and recharge to the aquifer, will be implemented.

Alternative 2 involves groundwater extraction (pumping) of approximately 6,200 gallons per minute (gpm) near the leading edge of the plume for a period of 30 years. The actual design capacity of the extraction and treatment facilities will be determined during the Remedial Design phase based on refined groundwater information and modeling. The RI/FS Report analysis indicated that the final extraction rate is expected to be within the range of 5,000 gpm to 7,000 gpm. Individual wells would pump from 800 to 2,000 gpm, the range for a typical city drinking water well. During the remedial design phase the locations proposed for extraction wells and scenarios for rates of extraction per individual well may be selected or new ones may be selected. The exact number, location and other design specifics of new extraction wells will be determined during the remedial design phase of the project to inhibit the migration of the contaminant plume most effectively.

All the extracted contaminated groundwater shall be treated to remove VOCs by either of two proven treatment technologies: **granular activated carbon (GAC) filtration** or **air stripping**. EPA determined during the Feasibility Study (December 1994) that these treatment technologies are equally effective at removing VOCs and are similar in cost at this OU. Both technologies have been proven to be reliable in similar applications. Existing treatment facilities (e.g., the GAC treatment system at the 19th Street wellfield) may be modified and incorporated into the remedy as appropriate. The VOC treatment technology which best meets the objectives of the remedy for the Muscoy Plume OU will be determined during the remedial design phase, when more detailed information is available to assess effectiveness and cost.

The treated water exiting the treatment plant shall meet all applicable or relevant and appropriate MCLs, non-zero MCLGs and secondary drinking water standards. If air stripping treatment is selected, air emissions shall be treated using the best available control technology (e.g., vapor phase GAC or an acceptable innovative technology) to ensure that all air emissions meet ARARs.

The treated water will be piped to the public water supply agency for distribution. Construction of pipeline to a distribution system capable of accepting the full volume of treated water would be required. It may be possible to use an existing treatment plant site with construction of pipeline to the plant and from the plant to the distribution pipeline.

Groundwater monitoring wells will be installed and sampled regularly to help evaluate the effectiveness of the remedy. More specifically, groundwater monitoring will be conducted no less frequently than quarterly to obtain information needed to: 1) evaluate influent and effluent water quality, 2) determine and evaluate the capture zone of the extraction wells, 3) evaluate the vertical and lateral (including downgradient) migration of contaminants, 4) (if the contingency

alternative is implemented) to evaluate the effectiveness of the recharge well system and its impact on the remedy and 5) to monitor any other factors associated with the effectiveness of the interim remedy determined to be necessary during remedial design. Monitoring frequency may be decreased to less than quarterly if EPA determines that conditions warrant such a decrease.

EPA has selected Alternative 5 as a contingency if the public water supply agency does not accept any or all of the treated water (possibly due to water supply needs). Any remaining portion of water will be recharged into the aquifer via reinjection wells near the edge of the plume. The number, location and design of the reinjection wells will be determined during the remedial design phase to best meet the objectives of the remedy and meet applicable or relevant and appropriate requirements. With the exception of the need to meet state reinjection standards and final use of the treated water, the extraction, treatment and monitoring components of Alternative 5 are identical to Alternative 2 above.

The total duration of the Muscoy Plume OU interim remedy will be approximately 33 years, with the first three years for design and construction. EPA will review this action every five years throughout this interim remedy period and again at the conclusion of this period.

The VOC treatment plant of the Muscoy Plume OU interim remedy (whether it be Alternative 2, Alternative 5 or a combination thereof) shall be designed and operated so as to prevent the unknowing entry, and minimize the possible effect of unauthorized entry, of persons or livestock into the active portion of the facility. A perimeter fence shall be erected around the VOC treatment plant if an adequate fence or other existing security system is not already in place at the plant site. This fence should be in place prior to initiation of the remedial action and should remain in place throughout the duration of the remedy. The VOC treatment plant shall also be designed and operated so as to prevent releases of contaminated groundwater from the plant.

The selected remedy for the Muscoy Plume OU meets all of EPA's nine evaluation criteria. The selected remedy is equally effective as the other alternatives in the short-term and long term reduction of risk to human health and the environment by removing contaminants from the aquifer, by inhibiting further downgradient migration of the contaminant plume, and by reducing the toxicity, mobility and volume of contaminants in the aquifer.

The VOC treatment technologies selected (liquid phase GAC or air stripping with best available control technology for emissions) are technically feasible and proven effective at meeting ARARs for VOCs in the treated groundwater.

Alternative 2, in combination with Alternative 5, could be implemented, both technically and administratively.

In a letter dated March 21, 1995, the State of California concurred with EPA's selected remedy. EPA received several public comments during the public comment period, the majority of which generally expressed support for Alternatives 2 through 5, although reservations were expressed about alternatives 3, 4 and 5. EPA received comments from water agencies in the area specifically in support of the end use aspects of alternatives 2 and 3. These comments, along with EPA's responses are presented in Part III of this ROD, the Responsiveness Summary.

The selected remedy is protective of human health and the environment, meets ARARs, and provides beneficial uses (distribution to a public water supply agency and/or recharge) for the treated water. The selected remedy is cost-effective. The estimated cost of Alternative 2 has a total present worth of $26,000,000, which is in the middle of the range for all five alternatives. The estimated total cost of Alternative 5 is $30,800,000.

12. STATUTORY DETERMINATIONS

As required under Section 121 of CERCLA, the selected interim remedial action is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the interim remedial action, and is cost effective. The selected remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment to reduce toxicity, mobility, and volume as a principal element.

The selected interim remedial action is protective of human health and the environment in that it removes significant VOC contaminant mass from the upper zones of the aquifer and inhibiting further downgradient and vertical migration of contaminated groundwater.

The VOC treatment technologies selected (liquid phase GAC or air stripping with best available control technology for emissions) are technically feasible and proven effective at meeting ARARs for VOCs in the treated groundwater and the air.

The selected remedy permanently and significantly reduces the toxicity, mobility and volume of hazardous substances in the aquifer as well as the extracted groundwater.

Because this remedy will result in hazardous substances remaining on-site above health-based levels, EPA shall conduct a review, pursuant to CERCLA Section 121, 42 U.S.C. Section 9621, at least once every five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

13. DOCUMENTATION OF SIGNIFICANT CHANGES

No significant changes to EPA's preferred alternative resulted from comments received during the public comment period.

PART III. RESPONSIVENESS SUMMARY

For PUBLIC COMMENTS RECEIVED from

DECEMBER 14, 1994, through JANUARY 20, 1995

ON THE PROPOSED PLAN FOR THE

MUSCOY PLUME OPERABLE UNIT INTERIM REMEDIAL ACTION

AT THE NEWMARK GROUNDWATER CONTAMINATION SUPERFUND SITE,

SAN BERNARDINO, CALIFORNIA

This section summarizes and responds to all significant comments received during the public comment period (38 days) on EPA's proposed interim cleanup plan for the Muscoy Plume Operable Unit of the Newmark Groundwater Contamination Superfund Site in San Bernardino, California. This summary is divided into two parts. Part 1 provides a summary of the major issues raised in written comments contained in three letters received by EPA during the comment period. Part 2 summarizes the questions and comments made during the public meeting on the Proposed Plan held in San Bernardino on January 10, 1995. Copies of all the written comments received by EPA are included in the Muscoy Plume OU Administrative Record, available for review at the information repositories for the Newmark Superfund Site. The transcript of the public meeting, including all the questions and comments made during the meeting, is also available at the information repositories.

1. WRITTEN COMMENTS

1) Commenter (San Bernardino Valley Water Conservation District) emphasizes that, "..it is imperative that the Muscoy plume, as well as the other contaminant plumes, be cleaned up as rapidly as possible." Commenter provides estimate of water in storage in the basin an estimate of volume contaminated.

EPA response: EPA appreciates this expression of support for the interim action at the Muscoy plume. Reaction to a hazardous chemical release must balance the need for rapid response with careful data gathering and analyses. During this project, EPA has maintained a bias toward timely action (such as the Muscoy Plume Interim Action) and will continue to seek opportunities to streamline the process.

2) Commenter recommends consideration of spreading the treated water in an existing gravel pit in the Lytle Creek area as an alternative to reinjection. Commenter notes that reinjection is a

costly alternative.

EPA response: Recharge of treated water to the aquifer will only be considered as a contingency in the event that acceptance by water supply agencies cannot be negotiated. EPA expects that these negotiations will be successful. The Feasibility Study did not identify existing gravel pits suitable for spreading (recharging) water all year round at the volumes necessary to meet the objectives of the Muscoy Plume OU.

3) Commenter (California Regional Water Quality Control Board, Santa Ana Region) expresses support for Alternatives 2 and 3 (Extraction and treatment using Granular Activated Carbon or air-stripping technology). Commenter also emphasizes the importance of protecting downgradient water supply wells.

EPA response: EPA appreciates the careful review and expression of support.

4) Commenter (West San Bernardino Valley Water District) expresses interest in accepting treated water from the cleanup project at a reasonable price if all federal and state water quality requirements are met. This letter was forwarded from the City of San Bernardino Municipal Water Department which is coordinating local water supply agency negotiations to accept treated water from the Newmark Superfund Site interim remedial actions.

EPA response: The active participation of local water supply agencies in the Muscoy Plume OU and the Newmark Superfund Site in general is respectfully acknowledged. Support of the proposed alternative by the water supply agencies of the community is important in the selection of the remedy for this Operable Unit.

2. COMMENTS FROM PUBLIC MEETING HELD JANUARY 10, 1995

Lee Brandt (written and oral comment)

5) Commenter notes that he had played around Camp Ono (potential source area) as a child and has developed serious health problems. Commenter recommends public notice be given to people who played in the area that they were exposed to carcinogens.

EPA response: This comment is about the source and does not directly address the Muscoy Plume interim action. The State of California and EPA searched extensively for surface contamination throughout the potential source area but did not detect any remaining VOCs. Since the contaminants of concern are quite volatile, it would be unusual to detect any significant surface contamination even a year or two after the release. Our analyses do not indicate any current exposure except through untreated groundwater, and the state and local water supply agencies prevent untreated contaminated water from entering the water supply system. Your suggestion about addressing past exposures has been forwarded to the Agency for Toxic Substances and Disease Registry (ATSDR). They have been requested to contact you directly.

Jeff Wright

6) Commenter objects to operation of existing air-stripping towers (at Newmark OU) without emission control systems in light of possible restrictions on backyard barbecues in the region as a result of air quality issues.

EPA response: This comment is indirectly pertinent to the Muscoy Plume OU, in that air-strippers are considered a possible treatment technology for the contaminated groundwater. EPA has committed to meeting the South Coast Air Quality Management District's emission control requirements if this technology is used. The existing air-stripping towers at the Newmark and Waterman wellfields in San Bernardino meet the applicable air quality requirements. Studies conducted by the City of San Bernardino have concluded that current emissions do not pose a health hazard. The comparison of risk from the untreated air emissions versus the risk from partially combusted charcoal from all of the backyard barbecues in San Bernardino is an issue beyond the scope of this Superfund project.

7) Commenter suggests that permitting of the Newmark air-strippers without emission control systems is a breakdown of the environmental regulatory process.

EPA response: As noted above, the existing treatment systems in San Bernardino meet the applicable air quality requirements. Studies conducted by the City of San Bernardino have concluded that current emissions do not pose a health hazard. EPA has committed to meeting the South Coast Air Quality Management District's emission control requirements if the air-stripping technology is used.

8) Commenter feels that regulators have been incapable of preventing the San Bernardino aquifer from being contaminated by two or more Superfund sites.

EPA response: Aquifers like the one beneath San Bernardino are vulnerable to releases of contaminants to the soil surface. It is important to recognize that contamination of the aquifer is believed to have originated more than 20 years ago, from sources that are not likely to reoccur given current regulation of hazardous substances.

Frank Vera

9) The commenter notes that it is misleading to have separate names for the Newmark and Muscoy Plume OUs, when the problem is actually the Camp Ono Contaminant Plume.

EPA response: Operable units are discrete actions that comprise incremental steps toward a comprehensive solution for the entire site. Despite the complexity of the Newmark Superfund Site geology and the difficulties inherent in investigating groundwater contamination 500 feet beneath an urban area, EPA was able to show that the Newmark plume and the Muscoy plume originate from the same area. It has not been established which of several potential sources are responsible for the contamination, and it would be premature to declare this the Camp Ono site.

10) The commenter feels that EPA has made their presentation as if EPA were doing the public a favor when EPA is actually required by law to address the contamination. In addition the

commenter believes that there has not been sufficient effort to uncover the real sources (Manhattan Project, Ethyl Corporation, Kaiser Steel, Culligan Zeolite).

EPA response: The record is clear that EPA is responding to the Newmark site in accordance with the requirements of the CERCLA statute and the National Contingency Plan (NCP) regulations. All the potential sources mentioned as well as many others have been considered by EPA. After analysis of the information gathered to this point, EPA has decided not to pursue the sources mentioned since the nature of chemical usage, location, time frame of operation or a combination of these factors are not consistent with the location and nature of the Newmark Superfund Site groundwater contamination. For example, the Ethyl Corporation facility was located near the leading edge of the Muscoy plume and the pattern of contamination shows that the plume originated miles to the northwest of this facility.

11) The commenter asserts that the source is the former military base (Camp Ono) and the federal government should be cleaning it up. The commenter further states that the source is actually a major military complex that wraps all around the Shandin Hills and includes a former Naval hospital northeast of the Shandin Hills.

EPA response: EPA's investigation into the source (the Source OU) is focusing on the general area of the former San Bernardino Engineering Depot (Camp Ono), although other origins cannot be ruled out. The pattern of contamination is not consistent with releases from potential sources north and east of the Shandin Hills. The pattern of contamination is also inconsistent with releases from the WWII incendiary manufacturing operation southeast of Camp Ono (often referred to as the "bomb plant").

12) The commenter feels that more emphasis must be paid to a secret pre-Manhattan (nuclear weapons) military project at the "Bomb Plant Complex".

EPA response: The San Bernardino Engineering Depot (Camp Ono) was an operation of the Corps of Engineers and the Quartermaster Corps during WWII on land leased from private parties. EPA has no credible evidence that any secret research went on there. All the wells in the area show the same low levels of naturally occurring radiation, including wells several miles upgradient of the depot and in portions of the basin hydrologically isolated from any potential influence from the depot.

13) The commenter is concerned that the groundwater had been contaminated and people were exposed to hazardous chemicals for 30 to 40 years because the bomb plant complex was kept secret.

EPA response: State and local water supply agencies responded immediately when the groundwater contamination (by VOCs) was discovered as part of a statewide Department of Health Services initiative to test groundwater for unexpected solvents. The state's investigation at that time discovered contamination in a number of other basins unrelated to military bases. See previous responses concerning past exposures (Comment #5) and evidence of military operations (Comments #9, 11 and 12).

John Stevens

14) The commenter feels that EPA has not taken radioactive contamination seriously, since the Newmark Superfund Site contamination seems like the same problem as Norton Air Force Base which does have radiation problems and chlorinated solvents together.

EPA response: (See response to Comments #11 and 12 above)

15) The commenter expresses doubt and frustration that the VOC contaminant levels reported in the EPA Remedial Investigation Report and related sampling reports are in parts per million rather than parts per billion. The commenter is concerned that the true concentrations are in parts per million and that these levels would cause problems with adequate treatment. The commenter reasons that EPA would not be proposing an action if the contaminants were really in the parts per billion since, "...then it wouldn't be a real problem."

EPA response: All EPA documents show that the contaminant levels of VOCs at the Newmark Superfund Site have been in the microgram per liter (parts per billion) range. Drinking water standards for both PCE and TCE are 5 micrograms per liter (parts per billion). EPA is concerned about contamination at this level and is responding to this release in order to meet the drinking water standards.

16) The commenter insists that more effort needs to be expended on explaining what was really going on at the 2700 acre complex at Camp Ono. He suggests that uranium tetrachloride was produced at the base, and that the nearby Ethyl Corporation was involved in producing tetrachlorides and ethylene as well as deuterium needed for nuclear activities.

EPA response: EPA is conducting a thorough subsurface investigation in the Camp Ono area. EPA is continuing to work with the Department of Defense to provide a more detailed account of activities at the former depot. The history of the San Bernardino Engineering Depot is available in the Administrative Record. The Army leased 1600 acres and all leases ended by 1947. See previous responses concerning radioactivity (Comment #12) and involvement of other facilities in the area (Comment #11).

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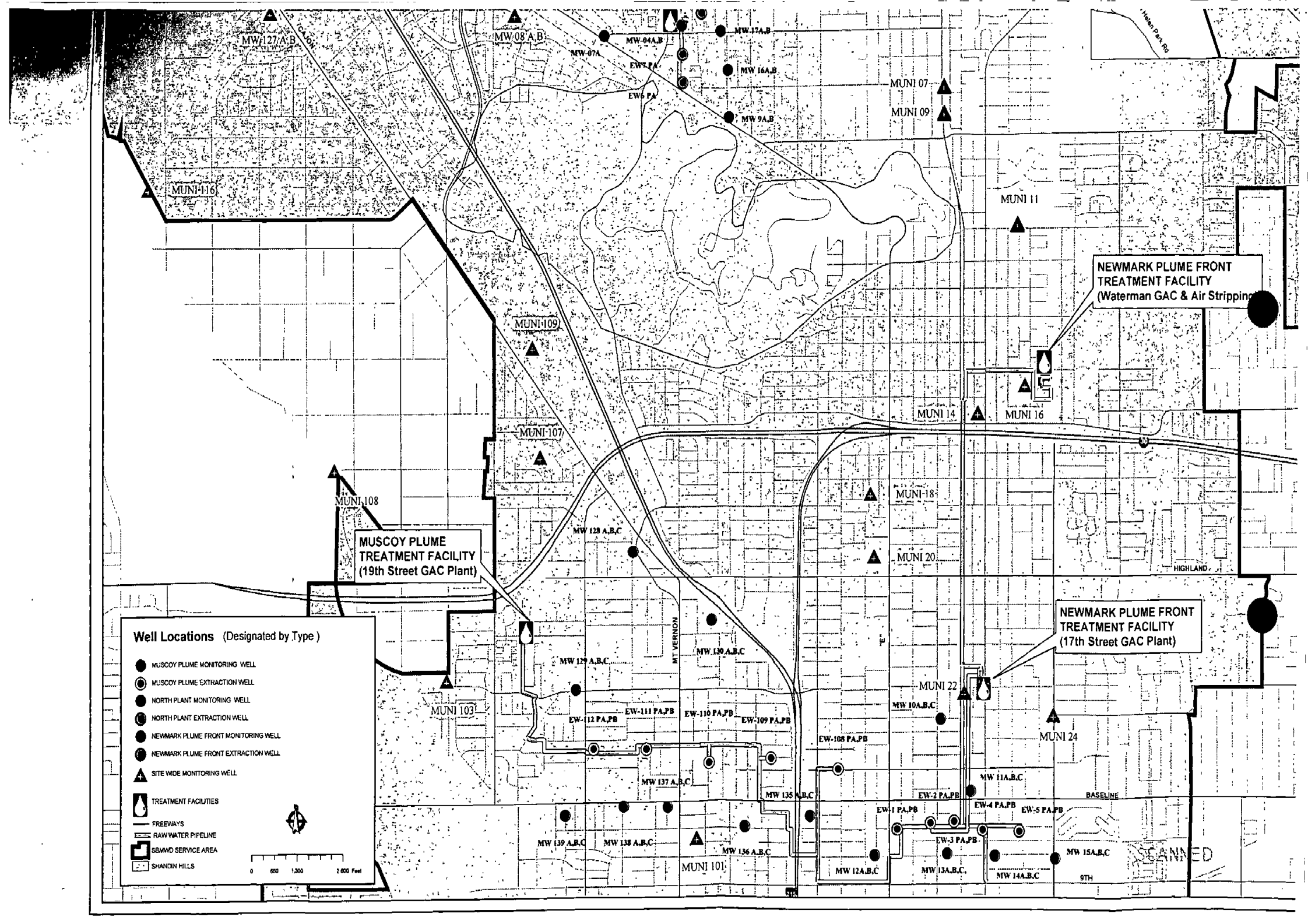
MW 127 A,B
MW 08 A,B
MW 17A,B
MW-04A,B
MW-07A
EW-7 PA
MW 16A,B
EW-6 PA
MW 9A,B
MUNI 07
MUNI 09
MUNI 116
MUNI 11
NEWMARK PLUME FRONT TREATMENT FACILITY (Waterman GAC & Air Stripping
MUNI 109
MUNI 14
MUNI 16
MUNI 107
MUNI 108
MUNI 18
MUSCOY PLUME TREATMENT FACILITY (19th Street GAC Plant)
MW 128 A,B,C
MUNI 20
HIGHLAND
NEWMARK PLUME FRONT TREATMENT FACILITY (17th Street GAC Plant)
MT VERNON
MW 130 A,B,C
MW 129 A,B,C
MUNI 22
MUNI 103
MW 10A,B,C
EW-112 PA,PB
EW-111 PA,PB
EW-110 PA,PB
EW-109 PA,PB
EW-108 PA,PB
MUNI 24
MW 137 A,B,C
MW 11A,B,C
MW 135 A,B,C
EW-2 PA,PB
BASELINE
EW-1 PA,PB
EW-4 PA,PB
EW-5 PA,PB
EW-3 PA,PB
MW 139 A,B,C
MW 138 A,B,C
MW 136 A,B,C
MUNI 101
MW 12A,B,C
MW 13A,B,C
MW 14A,B,C
MW 15A,B,C
9TH
Well Locations (Designated by Type)
MUSCOY PLUME MONITORING WELL
MUSCOY PLUME EXTRACTION WELL
NORTH PLANT MONITORING WELL
NORTH PLANT EXTRACTION WELL
NEWMARK PLUME FRONT MONITORING WELL
NEWMARK PLUME FRONT EXTRACTION WELL
SITE WIDE MONITORING WELL
TREATMENT FACILITIES
FREEWAYS
RAW WATER PIPELINE
SBMWD SERVICE AREA
SHANDIN HILLS
0 650 1,300 2,600 Feet
SCANNED